



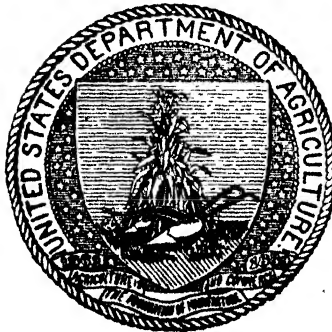
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EXPERIMENT STATION RECORD

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EXPERIMENT STATION RECORD.

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No. 1.

For the past 30 years it has been the custom of the *Record* to summarize more or less fully the annual acts making appropriations for the support of the Federal Department of Agriculture. This policy has been followed because of the wide public interest in the progress of the department and its relations to various agencies for agricultural advancement within the States, and because these acts, authorizing in considerable detail its expenditures for the ensuing fiscal year, to a large extent forecast its program for the months to come.

The latest of these acts, making appropriations for the fiscal year ending June 30, 1923, was signed by President Harding May 11. Aside from the actual appropriations it carries, it is a measure of considerable special interest. It is the first agricultural appropriation act to become law under the present administration, and also the first since the passage of the budget legislation and the completion of the altered legislative procedure in handling appropriation bills.

The congressional procedure has now been modified in two important particulars. About a year ago jurisdiction over the appropriation bills in the House was recentralized in the Committee on Appropriations, and it is to a subcommittee of this body instead of the Committee on Agriculture that the last two bills have been referred. Early in 1922, a similar change was brought about in the Senate, where, however, three members of the Committee on Agriculture and Forestry were retained as ex officio members of the Committee on Appropriations when considering the bill, and one of these three must be designated a member of the final conference committee of the two Houses. Additional restrictions were also thrown around the incorporation of new legislation.

The second innovation is the plan for the regrouping of all appropriations for a given department in a single measure, instead of distributing the items through several acts as in many cases in the past.

As regards the Department of Agriculture, this change is chiefly noticeable through the inclusion of \$800,000 as the printing fund of the department. This had hitherto been provided in the sundry civil appropriation act and its transfer apparently increased the department's funds accordingly, although in reality \$75,000 less is provided for printing and binding than was available during the preceding year.

The budget legislation established a Bureau of the Budget, charged among other duties with the correlation of all estimates and revenues. Departmental estimates are now submitted to this bureau, where they are scrutinized closely, such items as meet its approval and that of the President being transmitted to Congress for consideration. For the Department of Agriculture these estimates totaled \$36,532,868. Hearings were held upon the estimates by the House subcommittee much as under the former system, and the items were modified more or less by both the committees and the legislative houses themselves. The total carried by the act as finally adopted is \$36,774,173.

The new act undoubtedly indicates more accurately than any previous measure the funds at the department's disposal, though even now it is an incomplete guide. This is partly because of the large funds, estimated at \$12,250,000, available as "permanent and indefinite appropriations," such as \$3,000,000 per annum for the Federal meat inspection, \$4,580,000 for the extension work under the Smith-Lever Act, and a number of appropriations for the construction of roads and trails and other purposes by the Forest Service. Another difficulty encountered is through the passage of separate legislation applying to all departments of the Government, such as the joint resolution of June 30, providing the so-called "\$240 bonus" paid to most Government employees receiving less than \$2,500 per annum. This provision was continued for the ensuing year in lieu of the adoption of a salary reclassification law, the estimated expenditure for the Department of Agriculture being \$3,232,863. With these funds included, the total for the department approximates \$52,000,000. This is not far from the amount available for similar purposes during the preceding year.

In accordance with the policy of excluding general legislation from the appropriation acts, comparatively few items are included aside from the routine appropriations. Provision is made, however, for formally consolidating the Office of Farm Management and Farm Economics with the Bureau of Markets and Crop Estimates, to constitute the Bureau of Agricultural Economics. This change marks the final stage of a process of evolution in progress for some time, and is expected to result in numerous administrative advantages in view of the close relationships between the two component groups

of workers in such matters as the economic factors of production and distribution. Dr. H. C. Taylor, who has been in charge of the activities of the two branches for several months, has been appointed chief of the new bureau.

Another consolidation was made in the funds of the States Relations Service for extension and educational work into a single allotment of \$1,300,000 for "farmers' cooperative demonstration work, including special suggestions of plans and methods for more effective dissemination of the results of the work of the Department of Agriculture and the agricultural experiment stations and of improved methods of agricultural practice at farmers' institutes and in agricultural institutions." This action sets the seal of Congressional approval upon the consolidation of the extension work of the northern and southern offices effected in 1921, and combines with their funds the separate appropriation of \$16,360 carried for many years for the promotion of agricultural instruction through farmers' institutes and agricultural schools.

The authority omitted from the preceding act under which a 10 per cent interchange of appropriations under miscellaneous expenses of a bureau, division, or office may be made was restored. This action will permit of considerably greater flexibility as regards allotments to meet unforeseen seasonal or other emergencies.

No increases in salaries as regards chiefs of bureaus and other statutory employees of the department were granted, but a provision was appended to the act raising during the current year the maximum limit of \$4,500 for members of the scientific staff paid from the department's general appropriation. This provision will permit of lump fund salaries as high as \$6,500, but the number of individuals receiving over \$5,500 is restricted to three, while eight may receive salaries above \$5,000 but not exceeding \$5,500 each.

Taking up the allotments of the various bureaus and officers in detail, the largest appropriation was made to the Bureau of Animal Industry, its quota of \$6,968,076 exceeding for the first time in years that of the Forest Service, which receives \$6,562,302. This shifting of relative status is largely because of the bureau's tuberculosis campaign, for which \$2,877,600 was granted as compared with \$1,978,800 in the previous act. The latter sum had proved quite inadequate for the payment of the necessary indemnities, requiring a deficiency appropriation of \$600,000 to meet outstanding claims. At the present time the bureau is cooperating with the entire 48 States and the Territories of Alaska and Hawaii. It is announced that during the calendar year 1921 over 2,000,000 cattle were tested, of which about 3.9 per cent were reactors.

The remaining allotments of the bureau were not materially changed, although there were slight reductions in several items. One of these was a cut of \$5,000 for inspection and quarantine work in consequence of the discontinuance of the manufacture and distribution of blackleg vaccine. The funds for experiments and demonstrations in live-stock production in the cane sugar and cotton districts were reduced from \$51,500 to \$46,500, and those to maintain a live-stock department at the field station at Woodward, Okla., were reduced to \$6,500, of which \$500 may be used for additional sheds and other facilities. A grant of \$25,000 was made for constructing a vault on the department grounds to house the bureau's refrigerating plant, and one of \$5,000 to construct a sewage disposal system on the experimental farm at Beltsville, Md.

The Bureau of Plant Industry receives an increase in its funds from \$3,147,770 to \$3,527,910. The two chief points of increase are the barberry and the white pine blister rust campaigns, funds for the former purpose being enlarged from \$147,200 to \$350,000 and for the latter from \$100,000 to \$200,000. The citrus canker funds were reduced from \$79,720 to \$30,000, as it was thought this disease had been practically eradicated, but the discovery subsequent to the passage of the act of a new infestation in Florida has just necessitated the granting of supplementary funds of \$150,000 in a deficiency act. An increase of \$10,000 is provided for an investigation of a bacterial soft rot of potatoes and other vegetables, and one of \$12,000 for expert advice to the department inspectors as to the diseases of fruits at important receiving centers, and for further studies of pecan diseases.

A decrease of \$7,500 in the funds for acclimatization studies of cotton and other tropical crops, because of the virtual completion of a study of fiber plants for producing binder twine, is offset by a like increase for the studies of gall worms and other nematodes infesting plants. There is also a reduction of \$5,000 in the funds for the campaign against take-all and other wheat diseases, and an increase of \$17,000 for enlarging the studies of diseases of tomatoes, beans, and diseases causing loss during storage and marketing.

For pomological investigations there is an apparent increase from \$83,200 to \$121,700, but \$22,000 is merely a shifting of funds following the transfer of studies of fruits in transit from the Bureau of Markets and Crop Estimates. The remainder provides \$9,000 additional for fruit improvement work through bud selection and \$7,500 for studies of the physiological and related changes of fruits and vegetables in transportation and storage.

An increase of \$5,000 in the allotment for forage crop investigations is provided to look into the serious decline in red clover production, and one of \$9,000 in the miscellaneous appropriation of

,000 for demonstrations on reclamation projects to restore this work to its pre-war basis. There is also an allotment of \$50,000 to replace the central heating plant at the Arlington Experimental Farm, and the congressional seed distribution, though omitted in the estimates, is continued on the usual basis with an appropriation of \$360,000.

The aggregate of the appropriations for the Forest Service shows a decrease from \$6,990,302 in the regular and deficiency appropriations to \$6,562,302. This is in addition to miscellaneous funds of \$450,000 for the acquisition of additional lands at the headwaters of navigable streams (a reduction of \$550,000 from the previous year), \$400,000 for cooperative fire protection of forested watersheds in these areas, \$33,000 for emergency expenditures on the Olympic National Forest, and \$35,000 for the protection of certain areas in California and Oregon. If these items are included, the total for forestry work is \$7,480,302, a reduction of \$910,000. This expenditure is offset in considerable degree by the receipts from the national forests, which for the fiscal year 1921 amounted to \$4,468,000.

There is some readjustment of funds for the service, including the consolidation of the allotments of the 145 national forests into eight forest districts. The grant of \$50,000 for cooperation with the War Department in an airplane patrol over certain areas on the Pacific coast is eliminated. There is also a reduction from \$75,000 to \$60,000 in the funds for the classification and segregation of lands within national forests.

A fund of \$10,000 is provided specifically for the construction of sanitary facilities and fire preventive measures in public camp grounds in the forests. This is in consequence of the rapidly increasing use of these areas for recreation purposes, now estimated at about 6,000,000 visitors a year. Authority was given to extend the studies of means of utilization of forest products to such fibers as cornstalks, oat hulls and straw, and similar materials, and \$15,000 additional was granted to enable the Forest Products Laboratory to investigate the possibilities of flax straw for pulp and paper manufacture.

The appropriations of the Bureau of Chemistry were decreased from \$1,300,251 to \$1,277,631, partly because of a curtailment in the allotments for work with dye materials, table sirups, and dehydrated foods. The only new project contemplated is a study of the use of casina or youpon, a plant growing wild in the South Atlantic and Gulf States and thought to hold possibilities as a beverage somewhat similar to tea.

There was a decrease of \$21,840 for the Bureau of Soils, which will receive \$371,775. The reduction is mainly in the fertilizer

studies, for which \$70,000 is provided and the language reworded to read: "For investigations within the United States of fertilizers and other soil amendments and their suitability for agricultural use."

Considerable readjustment of the allotments for entomological work is made, and the total for the Bureau of Entomology is increased from \$1,669,280 to \$1,778,080. In addition \$547,840 is allotted for the pink bollworm campaign directed by the Federal Horticultural Board, \$13,000 for the eradication of the *Parlatoria* date scale, and \$25,000 for the control of the Mexican bean beetle. These latter sums are substantially as at present, but authority was given to expend \$200,000 of the pink bollworm funds in reimbursements to cotton-growing States for expenses incurred by them in connection with losses due to enforced nonproduction "cotton-free zones."

The principal item of increase for the bureau is that for preventing the spread of the gipsy and browntail moths. For the campaign against these pests \$600,000 is allowed, an increase of \$200,000, of which \$100,000 was made available for use in the spring of 1922. Material success against the gipsy moth is reported in the New Jersey area, where it is hoped to obtain complete extermination.

Funds for combating the European corn borer were reduced from \$275,000 to \$200,000, and the Secretary of Agriculture is empowered to expend \$75,000 of this amount only when an equal sum has been contributed by the States or interested sources. Another reduction is from \$40,000 to \$25,000 in the funds for grasshopper control, and there is also one of \$10,000 in the allotments for combating truck crop and stored product pests. On the other hand, an increase of \$15,000 is provided for studies of the so-called camphor scale, which has recently become established in New Orleans and is attacking not only camphor trees but citrus fruits, persimmons, grapes, pecans, plums, pears, figs, and many ornamental plants.

There are two principal points of increase in the allotments of the Bureau of Biological Survey. These provide \$35,240 to extend the campaign against wolves, coyotes, various rodents, and other injurious mammals, and \$15,000 for additional wardens to protect the land fur-bearing animals of Alaska. The total for the bureau is \$870,565.

The total appropriations under the States Relations Service were again decreased, falling from \$4,847,300 to \$4,585,960. This decrease is largely because of a reduction in the supplementary extension funds from \$1,500,000, as carried for several years and approved in the estimates, to \$1,300,000. It is offset as regards actual funds by the automatic increase of \$500,000 under the permanent appropriations of the Smith-Lever Act, which have now reached their maxi-

mun of \$4,580,000 per annum, though of course the full increase for agricultural extension from them which had been anticipated will not be realized because of the decrease in the supplementary funds. There is also a net decrease of \$53,280 for the department's own activities in extension work. The usual appropriations of \$1,440,000 are made for payments to the States under the Hatch and Adams Acts, \$210,000 for the insular experiment stations, and \$50,000 for the work of the Office of Home Economics.

In consequence of several small increases in allotments to the Bureau of Public Roads, its total funds under the act are enlarged from \$468,520 to \$483,320. There is a net increase of \$15,000 for the extension of economic studies of the wear and tear of highways through overloading of trucks, and a traffic survey of highway conditions and expenditures. Authority is also given the bureau to expend \$175,000, an increase of \$26,800, from the funds provided under the Federal aid road act, which with its supplementary legislation now constitutes the main source of income for the bureau's work. An apparent increase of \$8,000 transferred from the allotment of the Bureau of Markets and Crop Estimates is available for engineering problems relating to the handling, storing, and transportation of fruits and vegetables.

The consolidated Bureau of Agricultural Economics is granted \$3,556,183, an increase of \$136,909. Of this amount \$965,440 is for statutory salaries, \$36,273 for general administrative expenses, \$291,707 for the investigation of improved methods of farm management and farm practice (\$150,000 being for cost of production studies), \$471,200 for marketing studies, \$390,000 for crop and live-stock statistics (a net increase of \$107,600 to enlarge the live-stock reporting service and to extend the organization and personnel in foreign countries), \$175,000 for the market inspection of perishable foods, this inspection being made available if desired for intra-state as well as interstate shipments, \$405,000 for the market news service, and \$15,000 for the completion of the 1918 wool refunding work.

The funds for the enforcement of the various regulatory acts administered by the bureau were set at \$146,540 for the U. S. cotton futures act, \$536,223 for the U. S. grain standards act, \$120,000 for the U. S. warehouse act, and \$3,800 for the standard container act. Provision is also made for three new undertakings authorized by legislation within the year, \$165,000 being appropriated for the operation and management by the department of Center Market in the District of Columbia, \$410,500 for the enforcement of the packers and stockyards act of August 15, 1921, and \$103,600 for the enforcement of the future trading act of August 24, 1921.

The work of the remaining branches is continued without material modification. The Weather Bureau is granted \$1,925,235, an increase from \$1,886,570, mainly for its routine observations but with \$3,000 additional to extend the warnings given fruit growers regarding impending frosts. The Office of the Secretary receives \$451,920, the Division of Accounts and Disbursements \$55,820, the Federal Horticultural Board \$184,590, and the Insecticide and Fungicide Board \$156,510. There is an apparent increase for the Division of Publications from \$382,810 to \$427,830, but this is mainly because of the recent centralization in that division of the mimeographing and multigraphing work of the various bureaus, and other transfers. For the library an increase of \$6,200 is granted, making its total \$57,660. The department's fund for miscellaneous expenses is continued at \$161,000, together with \$2,500 to construct a vault for motion picture films and other inflammable materials, and \$181,866 for rent in the District of Columbia.

Considering the new act as a whole, despite the changed conditions under which it was prepared it is seen to present comparatively few innovations from those of recent years. For the most part, existing allotments and lines of work have been continued on the present basis, although some curtailments have been made as well as some relatively large increases. In general the increased appropriations are quite commonly to provide for new regulatory duties imposed upon the department or for combating specific plant and animal diseases, and reflect the favorable attitude of Congress of late years toward generous appropriations in both these directions. The approval of the establishment of the Bureau of Agricultural Economics and other plans for a more effective regrouping of the department's work is perhaps the most important development which the measure contains.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Third report on colloid chemistry and its general and industrial applications, F. G. DONNAN ET AL. (*Brit. Assoc. Adv. Sci., Rpt. Colloid Chem. [etc.]*, 3 (1920), pp. 154; also in *Brit. Assoc. Adv. Sci. Rpt.*, 88 (1920), App., pp. 154).—This report follows the plan of arranging the subject matter adopted in the two previous reports (*E. S. R.*, 41, p. 801), (1) according to the scientific subject, and (2) according to the industrial process. The subjects dealt with under the first head are as follows: Colloid Chemistry of Soap, Part I, Solutions, by J. W. McBain; Ultramicroscopy, by G. King; Solubility of Gases in Colloidal Solutions, by G. King; Electrical Charge on Colloids, by J. A. Wilson; and Imbibition of Gels, Part I, by J. A. Wilson.

The subjects considered under the second head are: Imbibition of Gels, Part II, Industrial Applications, by J. A. Wilson; Colloid Problems in Bread Making, by R. Whymper; Colloid Chemistry in Photography, by R. E. Slade; Collodion in Photography, by H. W. Greenwood; Cellulose Esters, by F. Sproxtton; Colloid Chemistry of Petroleum, by A. E. Dunstan; Asphalt, by C. Richardson; Varnishes, Paints, and Pigments, by R. S. Morrell; and Clays and Clay Products, by A. B. Searle.

Microchemistry of plants, H. MOLISCH (*Mikrochemie der Pflanze* Jena: Gustav Fischer, 1921, 2. ed., rev., pp. XI+434, figs. 155).—The volume previously noted (*E. S. R.*, 30, p. 310) has been revised to include the literature on the subject published since 1913, particularly Willsätter's studies on chlorophyll, carotin, and the anthocyanins and microchemical studies from the author's laboratory.

Reports of the progress of applied chemistry, 1919 and 1920 (*Soc. Chem. Indus. [London], Ann. Rpts. Prog. Appl. Chem.*, 1919, vol. 4, pp. 632, figs. 24; 1920, vol. 5, pp. 625, figs. 3).—These volumes continue for 1919 and 1920, respectively, the survey of progress in the subjects listed in the previous report (*E. S. R.*, 41, p. 613), with some few changes in topics and authors. The sections on agricultural chemistry in both volumes, as in the preceding, are by E. J. Russell.

Emil Fischer, his life and his work, K. HOESCH (*Ber. Deut. Chem. Gesell.*, 54 (1921), pp. 480, pl. 1).—This special number of this journal consists of a biography of Emil Fischer and an account of his most important chemical researches.

Agricultural and industrial bacteriology, R. E. BUCHANAN (*New York and London: D. Appleton & Co.*, 1921, pp. XVIII+468, figs. 67).—This volume is designed to serve as a general textbook or reference book on agricultural and technical bacteriology. The first three sections are of a general nature and deal, respectively, with the morphology and classification of microorganisms, methods of study, and the physiology of microorganisms. These are followed by three sections dealing with bacteria in technical agriculture and the industries, microorganisms and disease, and sanitary bacteriology.

Among the technical problems considered are the relationship of microorganisms to the preservation of food; alcoholic, lactic, acetic, butyric, and citric acid fermentation; the fermentation of polysaccharids and fats; the decomposition of organic nitrogenous compounds as in the ripening of cheese and meat; and bacteria of the soil.

The section on microorganisms and disease deals with human, animal, and plant diseases of bacterial and parasitic origin. The final section contains chapters on the bacteriology of water and sewage, with a discussion of sewage disposal, and on the bacteriology of milk.

Nitrogen compounds in alfalfa hay, H. G. MILLER (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 12, pp. 2656-2663).—A study of the distribution of nitrogen in alfalfa hay, similar to the one previously reported for alfalfa seed (E. S. R., 45, p. 501), has been made at the Oregon Experiment Station. By extraction of the ground alfalfa with 0.5 per cent potassium hydroxid, acidification of the extract with acetic or hydrochloric acid, and subsequent extraction with absolute alcohol in a Soxhlet extractor, a preparation containing 12.9 per cent of protein, 0.85 per cent of sulphur, and 1.27 per cent of ash was obtained. The average results of the analyses by the Van Slyke method of two samples of the protein are as follows: Amid N 6.18, humin N absorbed by lime 6.11, arginin N 13.82, histidin N 3.33, lysin N 11.04, cystin N 0.91, amino N in filtrate 55.98, nonamino N in filtrate 2.38, and total N recovered 99.75 per cent. In comparing these figures with corresponding data on the distribution of nitrogen in the seed, the most significant difference appeared to be in the higher content of arginin and of amid nitrogen in the leaf than in the seed.

After the proteins were removed from the water or dilute alkali extract of the ground alfalfa, the nitrogen content of the filtrate in either case was about 27.7 per cent of the total nitrogen. The nature of these nonprotein nitrogen compounds has not been determined definitely, but a purin fraction was isolated which contained 3.2 per cent of the total nitrogen.

The glycerids of goose fat, C. AMBERGER and K. BROMIG (*Ztschr. Untersuch. Nahr. u. Genussmittel*, 42 (1921), No. 9-10, pp. 193-218).—An extensive study of the glycerids of goose fat is reported, from which the conclusion is drawn that the fat contains a simple glycerid, triolein, which is the principal constituent of the fat and mixed glycerids consisting of two isomeric forms of steardipalmitin, palmitodiolein, and oleodipalmitin. The last-named constituent is present only in fresh fat.

The chemical composition of corn oil, W. F. BAUGHMAN and G. S. JAMIESON (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 12, pp. 2696-2702).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the physical and chemical characteristics of corn oil pressed by means of an oil expeller from corn germs produced by the so-called dry process, as described by Sievers (E. S. R., 44, p. 205). Some of the more important analytical constants are as follows: Specific gravity 25°/25° 0.9185, refractive index 20° 1.4717, iodine number (Hanus) 117.2, saponification value 187.3, unsaponifiable matter 1.7 per cent, acid value 2.5, acetyl value 10.0, saturated acids (determined) 12.3 per cent, and unsaturated acids and unsaponifiable matter (determined) 83.3 per cent.

The chemical composition of the oil is given as follows: Glycerids of oleic acid 45.4, linolic acid 40.9, palmitic acid 7.7, stearic acid 3.5, arachidic acid 0.4, lignoceric acid 0.2, and unsaponifiable matter 1.7 per cent.

The preparation of an edible oil from crude corn oil, A. F. SIEVERS and J. H. SHRADER (*U. S. Dept. Agr. Bul. 1010* (1922), pp. 25, figs. 7).—This publication includes the report of experiments on methods of refining corn oil

with a view to determining the best technique for such refining, estimations on the cost of refining, and detailed plans of a commercial refining plant.

The process of refining the oil involves three operations, (1) neutralization with caustic soda to remove the free fatty acids, (2) bleaching with fuller's earth, and (3) deodorizing with steam. Two methods of neutralizing were tested in one of which a large excess of caustic soda was used and in the other a small amount of caustic soda, followed after the "break," or separation of the soap, by soda ash to harden the soapstock. The first method with 10° B. caustic soda and the second with 14° B., using 50 per cent excess and 2 per cent soda ash, gave satisfactory results. The oil from the first method has to be washed to remove occluded soap, while the second does not, but the oil obtained by the first method bleaches somewhat better than that by the second method.

The maximum bleaching effect was obtained after 5 minutes' contact at 100° C. with 5 or 6 per cent of fuller's earth as obtained in the market. Heating the oil alone or treating with decolorizing carbons did not remove the color. A further bleaching was brought about during the deodorizing process. The optimum condition for the deodorizing was treatment with saturated steam at 200° under a vacuum of 25 in. for one hour. The deodorizing process alone resulted in a greater bleaching of the oil than the treatment with fuller's earth alone, but still better bleaching was effected by both treatments.

Using these methods of refining, practically no difference was noted in the color of the finished oil, whether obtained from the germs by the dry or the wet process.

To determine the relative cost of refining corn oil by the methods used in the experimental work reported, two 10-lb. batches of oil containing 1.76 per cent fatty acids were refined, the cost of each step in the process determined, and estimates made for similar treatment of 25,000-lb. batches of the oil. The difference in the cost of chemicals and the value of the oil lost in the two methods was 0.064 ct. per pound of refined oil in favor of the second method of neutralizing. This slight difference in cost, together with the fact that the second method does not require washing with brine to remove traces of soap, would seem to give the second method the advantage over the first. This is, however, balanced by the advantage of the former method in requiring no special handling of the soapstock to reduce refining losses.

A detailed description is given of a refinery capable of handling two batches of 25,000 lbs. of oil a week. The cost of refining the oil in such a plant, including overhead charges, is estimated at 1.6 cts. a pound.

Comparison of corn oils obtained by expeller and benzol extraction methods. A. F. SIEVERS (*U. S. Dept. Agr. Bul. 1054 (1922), pp. 20, fig. 1.*)—In this publication another phase of the corn-oil industry is discussed, that of extracting the oil by means of a solvent instead of by pressure. To determine the relative values of the two methods, a comparison has been made of the general characteristics and quality of three types of corn oil prepared from the same material: (1) By the expeller process, (2) by extraction with benzol from germs from the same source, and (3) by extraction with benzol from the oil cake obtained from the first-mentioned process. The oils were neutralized as in the second process described in the above paper, with the exception that the oil from the dry process germ cake required a large amount of caustic soda. The oils were all deodorized by a current of steam at 225° C. for two hours under a vacuum of 25 in. after the usual bleaching with fuller's earth. The expeller oils showed the smallest loss on treatment with caustic soda and the benzol-extracted oils from the oil cakes the greatest loss.

There were no noticeable differences in the physical and chemical constants of the various oils as determined directly after refining, but upon standing some deterioration took place which was more noticeable in the benzol-extracted oils than in the expeller oils. All of the oils, with the possible exception of that obtained by benzol extraction of the cake from wet process germs, were sufficiently light in color to make them suitable for edible purposes. The oils from the cake were inferior in all respects to the oils from the germs. It is thought possible that the benzol-extracted oils could be improved in quality by a more thorough deodorization than that to which the oils were subjected in these experiments.

The nature of hazel-nut oil, together with a contribution on the determination of arachidic acid, J. PRITZKER and R. JUNGKUNZ (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 42 (1921), No. 9-10, pp. 232-241).—Determinations of the analytical constants of two commercial samples of hazel-nut oil and two samples of oil prepared in the laboratory by ether extraction of hazel nuts are reported. The average results of the determinations of the laboratory sample are as follows: Specific gravity at 15° C. 0.9154, acid number 1.25, ester number 189.2, saponification number 190.45, and iodine number (Hanus) 84.59. A violet color was obtained with Bellier's test and an orange-brown color with nitric acid. Negative results were obtained with Baudouin's test and Halphen's test. Tests for arachidic acid were in general negative.

A modified method of determining arachidic acid, depending upon the principle that the potassium salts of the nonvolatile fatty acids are insoluble in a water solution of acetone while the potassium salts of the volatile acids are completely soluble, is described, and data are presented on the application of this test to hazel-nut oil, olive oil, and cottonseed oil containing varying amounts of peanut oil. Attempts to find a special reaction for hazel-nut oil were unsuccessful. While the addition of cottonseed oil and sesame oil to hazel-nut oil could be detected by the well-known color reactions, no test for detecting the presence of olive oil in hazel-nut oil could be found.

Analysis and composition of corn pollen.—Preliminary report, J. R. ANDERSON and W. L. KULP (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 433-453).—A study of the composition of corn pollen is reported from the New York State Experiment Station.

The analysis of pollen gathered in 1919 from Improved Leaming corn, a yellow dent variety, in percentage of the moisture-free pollen is as follows: Starch 11.07 per cent, nitrogen 1.53, reducing sugar as dextrose 3.50, sucrose 9.09, pentosans 10.00, crude fiber 5.35, crude fat or ether extract (average) 1.48, ash 3.46, phosphorus 0.63, sulphur 0.34, chlorine 0.19, and potassium 1.24 per cent. Partial analyses are also reported of the pollen obtained from two other varieties of corn, Luces Favorite White Flint and a pop corn, both gathered in 1920. These analyses show a striking difference in the values for starch and sucrose. The amounts of starch in the three varieties in the order named were 11.07, 19.04, and 18.03 per cent, respectively, and of sucrose 9.09, 2.97, and 14.18 per cent. It is suggested that these variations point to the possibility that the different varieties of corn may produce pollens of different composition, but that this conclusion can not be drawn definitely until more analyses have been obtained.

The composition of the ash from the yellow dent corn was phosphorus 18.92 per cent, sulphur 0.60, chlorine 0.80, silica (SiO_2) 3.76, calcium 1.02, magnesium 4.60, potassium 35.58, sodium 0.69, iron 0.25, and aluminum 0.22 per cent. A further examination of the pollen showed that it contains at least two phosphatids, one an amorphous substance containing sulphur and the other

a crystalline phosphatid. Relatively large quantities of free inosite, *l*-prolin, and cholin were obtained.

Castor bean lipase, its preparation and some of its properties, D. E. HALEY and J. F. LYMAN (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 12, pp. 2664–2670).—By extracting crushed hull-free castor beans with petroleum ether and passing the extracted material through a 40-mesh sieve, a satisfactory lipase material can be obtained which is somewhat soluble in fats or in a mixture of fat and ethyl ether but is insoluble in ethyl ether alone. This lipase zymogen is activated by acid, the optimum H ion concentration for lipase activity being at about pH=5, while at pH=3 activity stops entirely.

Petroleum ether added to a mixture of hard fat, acid, water, and castor bean lipase was found to accelerate hydrolysis of the fat to a great extent.

The preparation of flexible collodion membranes, J. M. LOONEY (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 1–4).—The membranes described are said to have the advantage over those described in the literature of maintaining their flexibility and permeability even after being dried for two weeks at room temperature. This flexibility is obtained by adding ethyl acetate to solutions of collodion in mixtures of absolute alcohol and dry ether. The collodion is prepared by adding to 5 gm. of “Anthony’s Negative Cotton,” previously dried for 48 hours over concentrated sulphuric acid, 25 cc. of absolute ethyl alcohol, followed after the flask has been agitated until the cotton is thoroughly moistened by 75 cc. of ether distilled over sodium. The flask is shaken until the cotton is completely dissolved, after which 15 cc. of ethyl acetate is added, with shaking to secure complete mixture of the solvents. The solution is allowed to stand over night, and the clear supernatant liquid is then decanted into another flask.

The membranes are prepared by pouring this solution into clean, dry test tubes or flasks of the desired size and allowing the excess collodion to drain back into the container by rotating it at an angle of about 60° until the collodion no longer drips freely. The flask is then clamped upside down in a stand and left until the membrane is completely dry, when it can be removed by peeling the top of the film from the neck of the flask and pouring a gentle stream of water between the membrane and the side of the flask.

Practicable substitutes for grain alcohol, L. E. GRIFFIN (*Science*, n. ser., 55 (1922), No. 1419, pp. 262, 263).—The author suggests the use of isopropyl alcohol or chemically pure methyl alcohol as a substitute for ethyl alcohol in biological work. It is stated that both of these alcohols have been tested against ethyl alcohol in the preparation of reagents. In histological work done with such reagents and stains, and in the preservation of museum specimens. All proved equally satisfactory except that methyl alcohol was the best dehydrating agent.

The determination of sodium in serum without the use of platinum dishes, S. J. WILSON (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 301, 302).—Results showing satisfactory agreement have been obtained in the Kramer-Tisdall method for the determination of sodium in small amounts of serum (E. S. R., 45, p. 716) with the use of platinum dishes and of cheap tin muffin dishes.

A rapid colorimetric method for the quantitative determination of the inorganic phosphorus in small amounts of serum, F. F. TISDALL (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 329–337).—The method described depends upon the precipitation of the phosphorus as strychnin phosphomolybdate with the strychnin molybdate reagent of Embden (E. S. R., 46, p. 415), the reduction of the molybdenum present in the precipitate by means of potassium ferrocyanid and hydrochloric acid, and the estimation of the phosphorus from the

intensity of the green color produced as compared with standards in the colorimeter.

It is stated that the presence of sodium, potassium, calcium, magnesium, dextrose, uric acid, acetoacetic acid, creatinin, and creatin in the concentrations found in normal and pathological sera does not interfere with the determination, and that the results are accurate to within ± 5 per cent of the amount of the inorganic phosphorus actually present.

Data are reported on the inorganic phosphorus content of the serum of normal adults and of normal infants. The average of seven determinations in the latter was 5.4 mg. per 100 cc., while 4.3 mg. per 100 cc. was the highest value obtained for normal adult serum.

The microdetermination of calcium in whole blood, plasma, and serum by direct precipitation. G. W. CLARK (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 487-517, fig. 1).—A micro method of determining calcium in blood plasma and serum by direct precipitation of the calcium with ammonium oxalate, subsequent solution in N sulphuric acid, and titration with potassium permanganate is described, and experimental data obtained in its use are presented and discussed. The method is thought to be accurate to ± 5 per cent and to possess several advantages over other procedures, particularly in the small amount of sample necessary, the saving in time, and minimal mechanical loss.

A modification of Folin's colorimetric method for the determination of uric acid. H. JACKSON, JR., and W. W. PALMER (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 89-101).—A modification of the Folin colorimetric method for determining uric acid in blood and urine, as improved by Folin and Wu (*E. S. R.*, 41, p. 13), is described. The essential feature of the modification consists in the preparation of the phosphotungstic acid reagent. Phosphotungstate B is prepared by boiling Folin's phosphotungstate reagent cautiously to dryness, and phosphotungstate D by dialyzing Folin's reagent in heavy parchment membranes against large amounts of tap water until all the free acid is removed and evaporating the solution to dryness. The proper mixture of these two reagents, which varies under the conditions of the experiment from $\frac{1}{4}$ to 1 part of B to 1 part of D, results in a reagent which is said to give a color nearly five times as intense as that given by Folin's procedure and with no interfering precipitate. The preparation of the reagents and the technique of the test are described in detail.

Detection of vegetable fats in animal fats.—The phytosteryl acetate test after precipitation with digitonin. C. F. MUTTELET (*Ann. Palsif.*, 14 (1921), No. 155-156, pp. 327-333).—To detect the presence of vegetable fats in animal fats, the author recommends the phytosteryl acetate test after precipitation with digitonin. The successive steps of the procedure consist in the saponification of the fat, the precipitation of the sterol as the digitonid with digitonin, the transformation of the latter into the acetate, and the determination of the melting point of the acetate. The technique of the method is described, and the values are given of the melting points of the sterol acetates obtained from butter and other fats as follows: Butter 114.2° C., pure lard 114, beef suet 114.3, peanut oil 126.5, cacao butter 124.5, a mixture of 1 part butter and 5 parts cacao butter 115.5, and 2 parts pure lard and 4 parts peanut oil 121.5°.

By a combination of this method and the test for the detection of suet in lard, previously described by Vitoux and Muttelet (*E. S. R.*, 46, p. 311), it is said to be possible to detect in a mixed fat the presence of two adulterants, one of vegetable origin and the other of animal origin.

New method for the detection of cacao butter in butter. C. F. MUTTELET (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 4, pp. 220-223).—The method described above has been applied to the detection of the adulteration of butter

with cacao butter. With pure butter of French origin the cholesterol acetate obtained had a melting point varying between 113.6 and 114.2° C. With butter to which various amounts of cacao butter had been added the melting point of the sterol acetate varied from 114.6° with 5 per cent of the adulterant to 118° with 30 per cent. It is concluded that the addition of cacao butter in as small amounts as 10 per cent can be easily detected by this method.

Distribution of certain drugs between immiscible solvents, W. O. EMERY and C. D. WRIGHT (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 11, pp. 2323-2335, figs. 4).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of determinations of the relative distribution of caffeine and of antipyrin between water and chloroform, with a view to their isolation from drugs and their quantitative determination.

The application of optical methods to the examination of insecticides and fungicides, G. L. KEENAN (*Jour. Amer. Pharm. Assoc.*, 10 (1921), No. 5, pp. 331-336).—The optical crystallographic methods described by Wherry (E. S. R., 39, p. 415) have been found by the author to be of application to the identification of the ingredients commonly found in insecticides and fungicides. A simple method of procedure for such tests is outlined.

An iodometric determination of copper and arsenic in the presence of each other, particularly in Paris green, I. M. KOITHOFF and C. J. CREMER (*Pharm. Weekbl.*, 58 (1921), No. 51, pp. 1620-1624; *abs. in Chem. Abs.*, 16 (1922), No. 4, p. 538).—The test depends upon the principle that if a neutral solution containing divalent copper and trivalent arsenic is treated with a pyrophosphate, the copper forms a complex which does not react with potassium iodid, but the iodine causes the trivalent arsenic to become quinquivalent. On the addition of acid the copper compound is decomposed, and treatment with potassium iodid reduces the copper with liberation of iodine. The technique is as follows:

A mixture of from 0.6 to 0.8 gm. of the sample and 5 gm. of sodium pyrophosphate is heated with 25 cc. of water until a clear solution is obtained. This is cooled to room temperature and titrated with N/10 iodine solution until the color changes from blue to blue-green. The amount of iodine required for this titration is a measure of the arsenic. To the solution is then added 10 cc. of 4 N sulphuric acid and 2 gm. potassium iodid. The flask is stoppered and allowed to stand for 5 or 10 minutes, after which the liberated iodine is titrated with N/10 sodium thiosulphate. Starch is added toward the end of the titration and the titration continued until the solution remains colorless for from 3 to 5 minutes.

Cause and remedy of the difficult defecation of cane juice, C. MUTLER (*Internat. Sugar Jour.*, 23 (1921), No. 274, pp. 579-581).—Previously noted from another source (E. S. R., 46, p. 616).

Emulsion problems in margarin manufacture, W. CLAYTON (In *The Physics and Chemistry of Colloids and Their Bearing on Industrial Questions*. London: Dept. Sci. and Indus. Research, 1921, pp. 22-26).—In this paper various colloidal problems which have to be considered in the making of a margarin emulsion are discussed, including the effects of different methods and degrees of agitation on the production of a stable and suitably phased emulsion of the fat and water (milk serum), of temperature, and of the nature of the various ingredients and emulsifying agents.

Determinations of drop numbers against water at various temperatures, using the Donnan drop pipette, have shown only a small difference in drop numbers for various edible fats and oils at a temperature of 35° C. against pure water, no change in drop number of oils with a free fatty acid content of from 0.05 to 5

per cent, and no appreciable difference with changes of temperature from 25 to 50°. The addition of salt and small amounts of gelatin appeared to promote the dispersion of oils and fats in water. Lactose was found to have a pronounced effect.

The utilization of carnauba-wax palm, C. GRIMME (*Pharm. Zentralhalle*, 62 (1921), No. 17, pp. 249-257).—This paper consists of a compilation from various sources of data on the composition of the different parts of the edible fruit obtained from the carnauba-wax palm (*Copernicia cerifera*), together with analyses from the author's laboratory of the various parts of the fruit and of the coffee substitute (Copernicia coffee) made from the roasted seed, the analytical constants of the oil obtained from the seeds, and the analysis of the fatty acids of the oil.

METEOROLOGY.

Some characteristics of United States temperatures, R. DEC. WARD (*U. S. Mo. Weather Rev.*, 49 (1921), No. 11, pp. 595-606, pls. 20; *rev. in Science*, n. ser., 55 (1922), No. 1420, pp. 292-295).—Maps prepared for the Atlas of American Agriculture are given, which show the average temperature for each month of the year, average winter temperature, lowest monthly mean temperatures for January and July, average daily range of temperature for January and July, lowest and highest temperatures ever observed, and average annual minimum temperature.

The article discusses the larger temperature relations of the United States; mean annual, monthly, and seasonal temperatures; midwinter and midsummer average temperatures; average winter and summer temperatures; mean annual ranges of temperature; annual migrations of the isotherms and of the temperature belts; the advent of spring; temperature gradients and their economic significance; occurrence of months and of seasons warmer or colder than normal; extreme limits of the mean temperatures of individual months; traditions regarding unusual seasons; recent studies of exceptional seasons; the question of permanent change in temperatures; temperature changes during 24-hour intervals; highest and lowest record temperatures; annual and monthly maxima and minima; and the question of persistent irregularities in the annual march of temperature.

Some phases of the climate of Manitoba in relation to agriculture, S. C. LEE (*Abs. in Bul. Amer. Met. Soc.*, 3 (1922), No. 3, p. 36).—The relation of the amount and distribution of rainfall and snowfall and the occurrence of killing frosts to the agriculture of this region is discussed.

"Frost, rather than rainfall, is the critical factor in agriculture in Manitoba. Only in a small area in the south center is the average date of last killing frost in spring before June 1, and the first in fall after September 11. Oats are characteristic of the more frosty portions of the agricultural area, and wheat of the less frosty. A short season, however, does not always mean a poor crop; in 1915 with a short frost-free period there was a bumper crop, while in 1914 with a long period there was a poor crop. The average length of the frostless season at Winnipeg is 116 days, but at the coldest place only 34-35 days. In some seasons (e. g. once at Souris) the frostless period may be only 10 days. At Russell (west-central) the shortest period has been 35 days and the longest 123 days. The yield of wheat is best in the west-central part, that of oats in west-central and in south and central."

Modal atmospheric streaming in wet and dry seasons in the Canadian wheat region, A. J. CONNOR (*Abs. in Bul. Amer. Met. Soc.*, 3 (1922), No. 3, pp. 35, 36).—"The modal or prevailing wind directions in several character-

istically wet or dry years are expressed numerically after Sandstrom's and Bjerknes' method and differentiated by isogons. From these the air streams which prevail in such seasons are constructed, and the occurrence of precipitation discussed in reference to the origin and lines of convergence of these prevailing streams.

"The three major streams of air are from the Hudson Bay region, the North Pacific Ocean, and the Gulf of Mexico. That from the northeast, on account of the coldness of its source, is dry; that from the west, because of the coolness of its source and the high mountains between the Pacific and the Great Plains of Canada, is rather dry; but that from the Gulf of Mexico is moist. One, two, or three of these streams are likely to control the summer weather of the Canadian wheat region. Without the northeast stream there is not sufficient energy to lift the Pacific stream and cause rainfall, except where the Pacific stream and that from the Gulf of Mexico meet. The wettest periods occur when the cold, northerly streams meets, and runs under, the warm, moist southerly one."

Prolonged plant activity at Grand Haven, Mich., in autumn of 1920, H. TULLSON (*U. S. Mo. Weather Rev.*, 49 (1921), No. 11, pp. 608, 609).—It is shown that "the prolonged activities of wild plants in November, 1920, in the vicinity of Grand Haven, Mich., were due not so much to the mildness of the autumn as to the fact that a snow cover protected vegetation during periods in which the temperature was low enough to destroy exposed plant life."

Analysis of summer precipitation at Mount Vernon, Iowa, W. A. MOORE and D. CORLETT (*U. S. Mo. Weather Rev.*, 49 (1921), No. 11, pp. 612, 613).—Chemical analyses of rains which fell from June 20 to August 1, 1921, are reported.

Artificial production of rain, H. JEFFREYS (*Nature* [London], 108 (1921), No. 2714, pp. 313, 314; also in *U. S. Mo. Weather Rev.*, 49 (1921), No. 11, pp. 614, 615).—Referring to recent activities of "rainmakers" in the United States, the author says: "Attempts have on many previous occasions been made to produce rain by artificial means, but the results have been uniformly unsuccessful." He briefly explains the reason for this.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 49 (1921), Nos. 11, pp. 595–636, pls. 32, fig. 1; 12, pp. 637–691, pls. 20, figs. 18).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for November and December, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 11.—Some Characteristics of United States Temperatures (illus.), by R. DeC. Ward (see p. 16); On the Depressions Observed in the Values of Solar Radiation Intensity, by L. Gorczyński; Prolonged Plant Activity at Grand Haven, Mich., in Autumn of 1920, by H. Tullson (see above); Heavy Snowstorm in Southern Michigan, November 8–9, 1921 (illus.), by D. A. Seeley; Tornadoes of November 17, 1921, in Arkansas, by W. C. Hickmon; Great Ice Storm of November 26–29 in Massachusetts; and Analysis of Summer Precipitation at Mount Vernon, Iowa, by W. A. Moore and D. Corlett (see above).

No. 12.—Streamflow at Wagon Wheel Gap, Colo. (illus.), by C. G. Bates and A. J. Henry, a rather full abstract of the report previously noted (*E. S. R.*, 46, p. 779); Recent Improvements in Solar Radiation Observations at Calama, Chile, by C. G. Abbot; On the Structure of Anticyclones and Cyclones in the Stratosphere over Europe (illus.), by F. M. Exner; The Toronto Symposium on Barometric Reductions, by C. L. Melsinger; Summary of the Hurricanes of 1919, 1920, and 1921 (illus.), by W. P. Day; Hailstorm in Alabama, November 14, 1921 (illus.), by P. H. Smythe; Great Rainstorm at Mount Wilson, Calif., Dec. 17–21, 1921 (illus.), by W. P. Hoge; Storm of November 19–22 in Oregon, Washington,

and Idaho, and Stormy Period Following (illus.), by E. L. Wells; The Clarkdale, Ark., Tornado of December 23, 1921, by J. H. Scott; and Tornado of December 24, 1921, in Northeastern Louisiana, by R. A. Dyke.

SOILS—FERTILIZERS.

Judgment of new processes for soil investigation, J. KÖNIG and J. HASENBÄUMER (*Landw. Jahrb.*, 56 (1921), No. 3, pp. 439-470, fig. 1).—Critical and comparative studies of processes for determination of the size of soil particles and their properties, for chemical studies with hydrochloric acid, for moisture determination, and for determining the behavior of lime compounds of soils toward the neutral salts of alkalis are reported.

It is concluded that the Atterberg sedimentation process for determination of the size of grains in soil mixtures will give the most exact results. On the other hand, it is said to be detailed and time-consuming, and it is considered highly desirable to simplify it. An effort in this direction is described in which the importance of using the soil in air-dried condition is emphasized.

The first two fractions, including those particles less than 0.002 mm. and those from 0.002 to 0.01 mm. in size, are considered to be of special importance in the judgment of soils in that they determine primarily whether a soil may be classed as sand, loamy sand, loam, or clay. These two fractions are also thought to govern largely the physical properties of soils.

It was found that the chemical composition and behavior of the individual fractions are very different. The reactive power of the fine fractions was extraordinarily great, but the chemical reactive power decreased as the size of particles increased. The finest fractions were also richer in plant nutrients, and this characteristic decreased as the size of grains increased.

Studies of moisture determination processes led to the conclusion that the direct determination of soil moisture is impossible. Direct determination by distillation with boiling hydrocarbons, according to the Hoffmann process, was found to be useless because the chemically combined water in the clay and silicates was only partially separated.

In the soil lime studies it was found that solutions of potassium and sodium chlorid have a dissolving action on the soil calcium in so-called exchangeable silicates and gypsum but only a slight action on calcium in the form of carbonate. Ammonium chlorid showed opposite actions. From these results methods of determining the amount of calcium carbonate, gypsum, and total lime present in soil are deduced. Other strictly chemical methods of study are discussed.

The specific weight of some soil constituents as influenced by size of particle, O. NOLTE (*Internatl. Mitt. Bodenk.*, 11 (1921), No. 3-4, pp. 117, 118).—Determinations of the specific weight of the different sized particles of precipitated silica and heavy clay showed the great superiority in specific weight of the finest particles over those next in size. Otherwise there was little difference in the specific weights of the particles.

McHenry County soils, J. G. MOSIER, R. W. DICKENSON, H. W. STEWART, E. VAN ALSTINE, and H. J. SNIDER (*Illinois Sta. Soil Rpt.* 21 (1921), pp. 50, pls. 2, figs. 7).—This survey deals with the soils of an area of 390,093 acres in northern Illinois lying in the Iowan and late Wisconsin glaciations, and reports analyses and field studies of the fertility requirements and crop adaptations of the prevailing soil types. The topography of the area varies widely from level terrace and swamp lands to decidedly rolling upland. Many swamps are found all over the county and the kettle holes on the moraines are frequently occupied by ponds.

The soils are of glacial and loessial origin. They are grouped as upland prairie, upland timber, terrace, late swamp and bottomland, and miscellaneous soils. Including water and gravel pits, 25 soil types are recognized, of which the yellow-gray silt loam upland timber soil, the brown silt loam upland prairie soil, and the black mixed loam swamp soil cover 21.34, 19.7, and 17.14 per cent of the area, respectively. The analyses indicate that the soils and subsoils are well supplied with potassium, but contain only limited amounts of nitrogen and phosphorus.

Soil survey of Louisa County, Iowa, L. V. DAVIS and J. A. ELWELL (*U. S. Dept. Agr., Adv. Sheets, Field Oper. Bur. Soils, 1918, pp. 50, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 253,440 acres in southeastern Iowa which consists in general of two areas of upland drift plain and two belts of low bottomland. The first bottoms are generally level, the terraces level to undulating, and the upland varies from level to sharply rolling or broken. It is stated that in both the eastern and western drift plains, with certain exceptions, ample surface drainage is afforded by widely ramifying branches and streamlets. The terraces are for the most part sufficiently drained for cultivation. Drainage conditions in the first bottoms are said to vary from wet pastures in narrow stream bottoms to well-drained bottoms along larger creeks.

The soils are of glacial, loessial, and alluvial origin. Including riverwash and muck, 28 soil types of 13 series are mapped, of which the Clinton, Tama, and Grundy silt loams cover 17, 10.5, and 10.4 per cent of the area, respectively.

Peat and peaty soils of Mount St. Michel (*Sta. Agron. Finistère et Lab. Dept. Bul., 1917-18, pp. 60-73*).—Data on the physical and chemical characteristics of some of the peats and peaty soils of northern France are presented and discussed, with particular reference to the industrial use of the peat for fuel and gas generation.

Analyses of the so-called marine peaty soils indicate that they contain organic matter in amounts up to about 25 per cent and as high as 15 per cent of moisture. They are rich in total nitrogen but deficient in lime, potash, and phosphoric acid. These soils require drainage and liming as first treatments. The so-called submarine peats are said to be heavier and less uniform than the marine peats. They make poor fuel, but contain considerable total nitrogen and are useful in composting.

Gullies: How to control and reclaim them, C. E. RAMSER (*U. S. Dept. Agr., Farmers' Bul. 1234 (1922), pp. 44, figs. 35*).—Popular information is given on gullies, their types, causes, occurrence, and results, and on the prevention and reclaiming of gullies by plowing in and seeding, tree planting, and the use of soil-saving dams.

Observations on residual soils on limestone, the question of Rendzina soils, K. VON SEE (*Internatl. Mitt. Bodenk., 11 (1921), No. 3-4, pp. 85-104*).—In this report six soil profiles are discussed, the purpose being to show the relation of so-called Rendzina or humus lime soils to podsol soils and to indicate the stages of transformation from the former to the latter. Humus lime soil is apparently an unusual and more or less indefinite formation resulting from the age-old weathering of limestone by humus deposits. This apparently results in an intimate mixture of humus and calcium carbonate.

The profile studies indicate that there are probably three stages in the formation of podsol from humus lime or rather an intermediate so-called bleaching out stage between the two.

Action of salt solutions on soil, O. NOLTE (*Landw. Vers. Sta., 98 (1921), No. 3-4, pp. 135-153, fig. 1*).—Percolation studies with a puddled humus sand soil to determine the influence of different salt solutions thereon are reported.

The chlorid, sulphate, and nitrate of sodium had similar actions. All three increased the permeability of the soil, but it gradually reverted to its original condition. When the soil was washed out it became heavily puddled. This condition was removed by adding calcium sulphate or sodium chlorid solution, the action of the former being the more marked in this respect. The three sodium salts caused an increase in the amount of nitrogen, potash, and lime in the seepage water and a decrease in the phosphoric acid, as long as the salt solution was active and the lime content of the seepage water was high. When the salt solution was washed out, the phosphoric acid content of the seepage water increased.

Sodium phosphate solution decreased the permeability of the soil. A further decrease resulted after washing the soil. The lime content of the seepage water was small. Sodium carbonate decreased the permeability still more, and almost complete imperviousness resulted from subsequent washing. Sodium bicarbonate considerably increased the permeability, which was reversed by washing. The reaction of the seepage water was weakly alkaline, and its contents of lime and phosphoric acid were small. These increased considerably after washing.

The chlorids of potassium and ammonium had the same influence as sodium chlorid. The action of potassium chlorid was more marked than that of ammonium chlorid. The chlorids of magnesium, calcium, and barium had the same general influence. The permeability was greater with the last two than with the first, and the decrease in permeability after washing was less where the last two salts were used. The content of phosphoric acid in the wash water was not so great with these salts as with sodium chlorid, otherwise these wash waters were similar. The chlorids of aluminum, iron, and silicon, stannic bromid, and phosphorus pentachlorid all increased the permeability of the soil by either large or small amounts. Subsequent washing increased the permeability.

The permeability of the soil was increased more by water saturated with carbon dioxid than by pure water. The lime content of the seepage water was greater by treatment with carbon-dioxid water than with pure water. The sulphate and phosphate of calcium increased the permeability more than pure water, but this was decreased by subsequent washing. Calcium carbonate had about the same influence on soil permeability as water. Calcium hydroxid decreased soil permeability and washing caused puddling. The nitrogen content of the seepage water was greater than with pure water. Calcium bicarbonate increased the permeability, but subsequent washing decreased it.

Studies on the phosphoric acid in soil and water.—I, The residual action of phosphoric acid fertilization and dissolved phosphoric acid in ponds, F. BREEST (*Internatl. Mitt. Bodenk.*, 11 (1921), No. 3-4, pp. 111-116).—Studies of the phosphoric acid content of the soil and water of ponds to determine the residual effect of phosphoric acid fertilization and to determine if the factors bringing reserve soil phosphates into solution are biological are reported. It was shown analytically that fertilization of pond soils enriches them in phosphoric acid. A residual effect of phosphoric acid fertilization was not analytically evident in the pond water. The phosphoric acid content of samples of water taken approximately over the soil studied was greater than that of ordinary water samples or of surface water.

Data obtained on the phosphoric acid content of water samples taken in the ordinary way are thought to be of conditional value. The term "phosphoric acid dissolved in pond water" is considered to be inaccurate. It is thought probable that the active biological factors lying in the limits or dividing surface

between water and soil are of considerable importance for the solution of soil phosphoric acid.

Sulphur as a factor in soil fertility, J. WOODARD (*Bot. Gaz.*, 73 (1922), No. 2, pp. 81-109).—Studies are reported in which composite soil samples from Indiana, Kentucky, Michigan, Ohio, and Wisconsin were analyzed for total sulphur, total phosphorus, and volatile matter, and cooperative fertilizer experiments with gypsum were conducted on fields in Indiana and Kentucky.

The analytical data show a general relation between the sulphur content and loss on ignition in soil samples from the same soil type or closely related soil types, but the relation is not apparent when different soil types are compared.

The sulphur contents in the surface soils were found to vary from 0.0118 to 0.0905 per cent, while the phosphorus contents varied from 0.036 to 0.3407 per cent. All of the upland soils and most of the alluvial soils were low in sulphur. Most of the Kentucky soils and one of the Indiana soils were high in phosphorus. The sulphur and phosphorus contents of the soils were calculated in pounds per acre in the surface soils and compared with the amounts of sulphur and phosphorus removed by maximum crops of corn, wheat, timothy, clover, and alfalfa. The highest sulphur content was found to be sufficient for only 39 years of alfalfa, 139 years of clover, 159 years of timothy, 355 years of wheat, or 232 years of corn. The lowest sulphur content is sufficient for only 5 years of alfalfa, 18 years of clover, 21 years of timothy, 46 years of wheat, or 30 years of corn. The lowest phosphorus content was found to be equal to the amount removed by 42 years of corn, 60 years of wheat, 80 years of timothy, 36 years of clover, or 20 years of alfalfa. The highest phosphorus content was equal to the amount which would be removed by 401 years of corn, 568 years of wheat, 757 years of timothy, 341 years of clover, or 189 years of alfalfa. On some of the soils tobacco, clover, and alfalfa were not benefited by the use of gypsum. The results, however, were not quantitative.

On nitrification.—III, **The isolation and description of the nitrite ferment**, A. BONAZZI (*Bot. Gaz.*, 68 (1919), No. 3, pp. 194-207, pl. 1).—This is the third paper of a series dealing with the subject of nitrification in soils (*E. S. R.*, 41, p. 623) and resulting from extensive studies at the Ohio Experiment Station, in which an organism is described which was isolated in a fine state from Ohio soil and is capable of forming nitrites from ammonia. It is thought that the results of the studies justify the classification of the organism isolated as a species of the genus *Nitrosococcus*.

On nitrification.—IV, **The carbon and nitrogen relations of the nitrite ferment**, A. BONAZZI (*Jour. Bact.*, 6 (1921), No. 5, pp. 479-499, figs. 3).—In a fourth contribution, a study is reported of the functions of autotrophic carbon assimilation and nitrogen nutrition of the nitrosoferment. These functions were found to be intimately connected and mutually interdependent, the bacterial cell being unable to assimilate the abundant stores of nitrogen in a nutritive solution in the absence of free carbon dioxide even though a carbonate as such be present in the medium. Consequently the process of nitrogen oxidation which follows the absorption and leads to the formation of nitrous acid and its salts is dependent upon the presence of this free carbon dioxide.

Influence of *Azotobacter* added to soil on the development of plants, M. FOUASSIER and J. LHOMME (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 7, pp. 155-158).—Studies on the inoculation of soil sterilized with formalin by pure cultures of *Azotobacter agilis* to determine their influence on crop growth are briefly reported. The soils were used both sterilized and unsterilized and with and without additions of composted manure. The best plant de-

velopment was obtained from sterilized inoculated soil without the addition of composted manure.

A plan for the conduct of fertilizer experiments, W. J. SPILLMAN (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 304-310).—A mathematical discussion of methods for the conduct of fertilizer experiments is presented, in which data from three different series of plats are presented and discussed.

The first series is adapted to research work on the relative effect of different quantities of a fertilizer and of the various fertilizer elements in different combinations. The second series is similar in purpose to the first, but is designed for use in regions where it is already known that one of the three elements is distinctly more of a limiting factor than the other two. The third series is designed for the use of farmers who want to experiment on their own farms. The first series for research work includes 36 plats, providing for direct comparisons of the three main fertility elements and combinations thereof.

Recommended standards for field plat experiments in soil fertility (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 9, pp. 368-371).—These standards as outlined cover soil, plat, soil treatment, and cultural operations.

Relative growth response of crops to each fertilizer ingredient and the use of this response in adapting a fertilizer analysis to a crop, B. L. HARTWELL (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 9, pp. 353-359).—In a contribution from the Rhode Island Experiment Station, methods for estimating the fertilizer needs of different crops are discussed. It is pointed out that the growth response to fertilizer constituents differs widely, and that crops must be grouped in accordance with their response to each of the fertilizer ingredients before they can be fertilized intelligently. In this connection 21 crops are tentatively divided into three groups on the basis of their relative growth response to individual applications of sodium nitrate, acid phosphate, and potassium sulphate or chlorid. This grouping is apparently made more as an illustration of a system for finally arriving at the fertilizer analyses adapted to different crops than with the expectation that the grading will prove to be accurate when subjected to further investigation. The use of the system is illustrated.

Relation of soil nitrogen, nitrification, and ammonification to pot experiments, G. S. FRAPS (*Texas Sta. Bul.* 283 (1921), pp. 5-51, figs. 3).—Studies on the relation of the total nitrogen, nitrate, and ammonia content of soil to the nitrogen removed by crops in pot experiments are reported.

It was found that the average weight of nitrogen removed by four crops increased with the percentage of total nitrogen in the soil, and the first crop was much larger than the succeeding crops. The average weight of the second crop on the soil containing the smallest amounts of total nitrogen was only 13.5 per cent of the first crop, and the fourth crop was 11.4 per cent, while for the soils highest in nitrogen, the second crop was 68.7 and the fourth crop 36 per cent of the first crop. The differences were not so large when the nitrogen removed was considered.

The four crops usually removed from 6 to 9 per cent of the total nitrogen of the soil or from 1.5 to 2 per cent per crop. On an average the nitrogen of surface soils was better taken up than the nitrogen of subsoils. Nonacid soils gave up more nitrogen to crops than acid soils, but many of the individual acid soils gave up more nitrogen than the corresponding nonacid soils. Little relation could be found between the nitrogen taken up by the crops and the active phosphoric acid of the soil, the acid consumed, or the lime.

There was a close relation between the amount of nitrogen removed by the first crop and the amount of available nitric nitrogen. The nitrogen removed

by the crops varied from 58.1 to 76.1 per cent of the nitric nitrogen with certain exceptions. The effect of cropping was clearly shown by the differences between the nitrification before and after cropping. There was a relation between the decrease in the nitric nitrogen formed and the amount of nitrogen withdrawn from the soil by the crops grown upon it.

The relation between the nitrates produced after cropping and the nitrogen removed by the third and fourth crops was not so close as the relation between the nitrates available before cropping and the nitrogen removed by the first crop. Of 233 soils, half of which had been cropped, 25 soils produced more than 0.1 part per million of ammonia nitrogen during the first nitrification period of four weeks, 8 of these produced over 2 parts per million, and only 3 over 5 parts per million. Only 20 of the 233 soils had available more than 5 parts per million of ammonia nitrogen, including that originally present in the soil.

With a few of the soils the ammonia determination offered some information, but as a rule this determination appeared to be unnecessary. With some soils the amount of nitrogen taken up by the crops was much less than the amount produced in the nitrification test. In other soils the opposite was true. The latter soils also produced more nitric nitrogen after cropping than they did before cropping.

In the correlation between the nitrogen content of the soil and the nitrogen taken up by the four crops, as estimated by statistical methods, the correlation coefficient R was 0.653 ± 0.029 . In the correlation between the total nitrogen of the soil and the nitrogen taken up by the first crop, R was 0.581 ± 0.033 . In the correlation between the amount of nitrogen taken up by the first crop and the amount of nitrates available in the soil, R was 0.708 ± 0.025 . There was thus a closer relation between the nitrogen taken up by the first crop and the nitric nitrogen used than between the total nitrogen of the soil and the nitrogen removed by the first crop. In the correlation for 56 soils with 0.021–0.04 per cent total nitrogen between the available nitrogen of the soil and the nitrogen removed by the first crop, R was 0.407 ± 0.074 . In the correlation for 52 soils with 0.041–0.06 per cent total nitrogen, between the nitric nitrogen and the nitrogen removed by the first crop, R was 0.556 ± 0.064 . In the correlation between the nitrogen taken up by the third crop and the nitric nitrogen found in the nitrification test after the cropping, R was 0.538 ± 0.036 . In the correlation between the nitrogen removed by the crops and the decrease in nitrification of the soil, R was 0.68 ± 0.029 . In the correlation between the total available nitrogen, that is, the ammonia nitrogen plus the nitric nitrogen and the amount of nitrogen removed by the first crop, R was 0.698 ± 0.036 on 95 soils.

It is concluded that the determination of ammonia gives no increased correlation over the determination of nitric nitrogen alone.

Fertilizer experiments. C. P. BLACKWELL and T. S. BUIE (*South Carolina Sta. Bul.* 209 (1921), pp. [78], figs. 52).—The results of a continuation for four years of fertilizer studies on a rotation begun in 1914 at the Pee Dee Station and previously described in Bulletin 193 of the station (E. S. R., 38, p. 816) are reported.

It was found that acid phosphate, ground rock phosphate, and Thomas phosphate gave equally good yields when applied at the rates used in this experiment on this particular soil and in the absence of the boll weevil. Acid phosphate gave an earlier crop of cotton than either ground rock phosphate or Thomas phosphate. Eight per cent of acid phosphate in a 1,000 lb. application

of fertilizer gave the maximum yield of cotton, and larger applications were not profitable. Corn and cowpeas when grown in a rotation with cotton did not respond to applications of phosphoric acid. Oats gave a small increase for 4 per cent of acid, but not for larger amounts.

Blood alone, as a source of ammonia, gave better results than a mixture of one-third blood and two-thirds cottonseed meal. Four per cent of ammonia was better than either larger or smaller applications for cotton continuously and for cotton in a rotation. The yields of corn and of oats were in direct proportion to the amount of ammonia applied, but the yield of cowpea hay was not influenced by the application of ammonia. The time of application of nitrate of soda as a side dressing made no difference in the yields of any of the crops in this particular experiment, because the soil had sufficient ammonia for a maximum yield of these crops without the side dressing.

Two per cent of potash was sufficient for a maximum yield of cotton in a rotation, and 4 per cent was best where cotton was grown continuously. Corn, oats, and peas gave no response to applications of potash. Muriate and kainit were of equal value as sources of potash for all crops used. Caustic lime and ground limestone were of equal value as sources of lime when used at the rates of 1,000 and 2,000 lbs. per acre, respectively. Lime was not profitable on this soil for any of the crops grown.

At the end of six years the rotation series was yielding approximately twice as much as the continuous cotton series and was gaining rapidly even where complete fertilizer was used at the rate of 1,000 lbs. per acre, thus showing the superiority of a rotation over a continuous cotton series for maintaining the fertility of the land. Either very heavy or very light applications of ammonia delayed the maturity of cotton. Heavy applications of potash also delayed maturity. The earliest crop of cotton was secured by a reasonable application of acid phosphate and ammonia, and from a well-balanced complete fertilizer which does not run high in any one element.

Investigation on the active value of soil nutrients on the basis of vegetation experiments and solubility determinations and on the productive value of different plant nutrients, O. LEMMERMANN, L. FRESSENIUS, and H. WIESSMANN (*Landw. Vers. Sta.*, 98 (1921), No. 3-4, pp. 155-185).—This is a continuation and completion of studies previously noted (*E. S. R.*, 45, p. 214). Clay, fine sand, and sand soils were used, and the purpose was to investigate the relative nutritive values of the nitrogen, phosphoric acid, and potash in the soils to oats.

It was found that these soils are generally richer in potash than in phosphoric acid. However, more phosphoric acid is soluble in 1 per cent citric acid solution than is available to plants, while the opposite is true for potash.

It is concluded that the determination of the relative solubilities of soil nutrients is in many cases a better indication of their availability to plants than the results of methods which give no indication of relative solubility.

Fertilizer, residual effect, and cropping experiments in Java and Sumatra.—Report for the west monsoon, 1919-1920, C. VAN ROSSEM (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Alg. Proefsta. Landb.*, No. 10 (1921), pp. 119).—The results of a large number of comparative studies of different fertilizers, including complete commercial fertilizers, fertilizers containing one or more fertility constituents, green manures, stable manure, and lime on different crops in Java and Sumatra during 1919 and 1920 are reported and discussed. A feature of this work was the determination of residual values from different treatments.

A series of manurial experiments at Lyallpur, 1912-1917, O. T. FAULKNER (*Punjab Dept. Agr. Rpt. 1920, pt. 2, pp. 187-191*).—Fertilizer studies with

different crops on the soils of Lyallpur, extending from 1912 to 1917, are reported. It was found that nitrogen is the most important fertility element controlling the growth of crops in these soils.

Influence of fallow v. stable manure fertilization on the nitrogen content of crops, T. PFEIFFER (*Landw. Vers. Sta.*, 89 (1917), No. 4, pp. 241-268, fig. 1).—The first part of a 12-year series of studies is reported to compare the influences of fallowing, legume growing, and stable manure fertilization on the nitrogen content of crops in a rotation including oats, peas, and beets. The soil used was a loam soil relatively well supplied with nitrogen.

It was found that periods of fallow in the rotation did not increase the nitrogen content of the crops as much as a legume in the rotation in spite of the action of the free living nitrogen-fixing bacteria in the fallow soil. It is concluded that the importance of these bacteria is overestimated and that they can not compare with the nodule bacteria of legumes. Results were obtained in the manuring experiments which are taken to indicate that sufficient importance has not heretofore been attached to the residual action of stable manure. Evidence was secured that this action is by no means exhausted in the fourth year under the conditions of the experiment.

Influence of fallow v. stable manure on crop yields and the nitrogen content of soil, T. PFEIFFER (*Landw. Vers. Sta.*, 98 (1921), No. 3-4, pp. 187-222).—In a second contribution to the subject, the completed results of the series of studies noted above are reported and summarized.

It is concluded that a well-established action of fallow tending to increase crop yields is exceptional, and occurs only under special and unusual conditions. The results obtained could not more markedly indicate the insignificance of fallowing in connection with favorable influences on the nitrogen content of soil, and showed the probability of losses of available nitrogen during fallowing by leaching.

The results of the studies with stable manure emphasized the importance of the residual action of manure in soil, which it is concluded is much better in many cases than average results would indicate. These results are also taken to indicate that stable manure is the best material for maintaining the so-called original strength of the soil.

Studies of the nitrogen balance of the soil as influenced by the factors tested showed that the decrease in the total nitrogen content of the soil was greater under the legume rotation than under the fallow rotation, but that the increase in the nitrogen content of the total crop from each rotation was the same. This is taken to indicate the greater value of the nodule bacteria of legumes than of the free living nitrogen-fixing bacteria of fallow for nitrogen fixation. The rotation including stable manure treatment had the most favorable influence on the nitrogen balance of the soil, this being attributed to the residual action of the manure.

Cultivation without live stock, M. HOFFMANN (*Arb. Deut. Landw. Gesell.*, No. 310 (1921), pp. 114, figs. 2).—A large amount of data obtained by a questionnaire sent to cultivators in different German Provinces is brought together in this report relative to cultural systems which do not involve the use of stable manure, the fertilization practices consisting of green manuring, fallowing, and the use of commercial fertilizers. This system seems to be favored as compared to systems of farming involving the keeping of live stock and the use of stable manure.

Green manuring experiments (*Punjab Dept. Agr. Rpt. 1920*, pt. 2, pp. 158-163, pls. 2).—Data from studies on the influence of a green manuring crop as a nitrogenous manure and in the improvement of the texture and moisture-retaining powers of wheat soils are reported.

The increases in weights of green and dry material from green manuring were more uniform on heavy soils than on light sandy soils, but in both cases were about three times the yields obtained from unmanured plots. The maximum returns were obtained only on the light sandy soils.

Data on the fluctuations of total and available nitrogen showed that although an addition of green manure roughly equivalent to 40 lbs. of nitrogen per acre was made, representing an increase in total nitrogen of about 5 per cent, the total nitrogen was in all cases diminished. This is considered to be probably due to losses of available nitrogen through leaching. While no conclusion is drawn, the moisture results are taken to indicate that the addition of green manure is mainly responsible for the increase in moisture-holding capacity required by the heavy crop growth.

Sillage disposal experiments (*Punjab Dept. Agr. Rpt. 1920, pt. 2, pp. 168-172, pls. 21*).—Experiments on the use of diluted sillage on wheat as a means for its disposal showed that the lowest yields were attained in all cases from soils treated with pure sillage. The best results were obtained by the use of a mixture of three-fourths sillage and one-fourth canal water. No increase in total nitrogen in the soil resulted from the heaviest applications of sillage. It was found, however, that on soils receiving pure and half-strength sillage a rapid denitrification took place, which is attributed to the addition of an excess of organic matter with the sillage.

Peat litter and peat mull, H. VON FEILITZEN (*Om Torrströ och Torrmull. Stockholm: Sveriges Allmänna Landtbr. Sällsk. Förlagsakt., 1921, pp. 80, pt. 1, figs. 27*).—General information on the value, obtaining, and practical use of peat litter and peat mull is given. Drawings of equipment for the manufacture of both materials from raw peat are included.

The effect of basic slag upon grassland and upon the corn crops obtained when that grassland is plowed up, A. W. OLDERSHAW (*Jour. Agr. Sci. [England], 11 (1921), No. 3, pp. 287-292*).—Studies on the influence of basic slag upon a typical chalky boulder clay soil supporting pasture are reported.

Soils receiving slag showed a marked increase in nitrogen content and a consequent increase in fertility. This is attributed largely to the fact that the slag favored a very vigorous growth of wild white clover, which increased the nitrogen assimilation and also the organic matter content. Crops on plowed grassland which had been treated with slag gave considerably greater yields than on unslagged soils.

Availability of potash in some soil-forming minerals, G. S. FRAPS (*Texas Sta. Bul. 284 (1921), pp. 5-16, figs. 3*).—Studies on the availability to crops of the potash in soil-forming minerals are reported in which potash was added in the form of minerals to soil at rates of 500 and 4,000 parts per million. Studies were also conducted on the fertilizer value of granite.

It was found that the amounts of potash taken up by one crop from microcline averaged the same as the quantity dissolved by fifth-normal nitric acid. The amount taken up from orthoclase was somewhat greater than that dissolved by acid. One crop removed from muscovite an average of from 30 to 70 per cent of the amount of potash dissolved by fifth-normal nitric acid, from biotite from 30 to 50 per cent, from stilbite 40, and from potassium sulphate 20, 30, and 40 per cent.

It is concluded that a relation exists between the solubility of the potash in soil minerals in fifth-normal nitric acid and the amounts removed by crops, and vice versa. Also that minerals which contain potash easily soluble in strong hydrochloric acid will give up their potash more readily to plants than those which contain potash less soluble in strong acid. Granite was found to have practically no value as a fertilizer.

The lime requirement of soil and plant, T. D. HALL (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 2, pp. 141-152).—A summary of information on the lime requirements of different crops and on the influence of different forms of lime on different soils is presented in this report, particular reference being made to the soils of South Africa.

Limestones in Southern Rhodesia, G. N. BLACKSHAW (*Rhodesia Agr. Jour.*, 19 (1922), No. 1, pp. 73-79).—Analyses of 65 samples of limestone rock from Southern Rhodesia are presented and discussed.

The chemistry of the oxidation of sulphur by microorganisms to sulphuric acid and transformation of insoluble phosphates into soluble forms, S. A. WAKSMAN and J. S. JOFFE (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 35-45, fig. 1).—Studies conducted at the New Jersey Experiment Stations on the subject are reported, the purpose being to present some of the principles involved in the oxidation of sulphur and the transformation of insoluble phosphates into soluble forms both by crude and by pure cultures of the sulphur-oxidizing organisms. The studies included the oxidation of sulphur in ordinary cultivated soil and in solution by *Thiobacillus thiooxidans*, and the transformation of insoluble phosphate.

It was found that the curve of sulphur oxidation, both in soil and in solution by pure and impure cultures of *T. thiooxidans*, is a growth curve. The mechanism of the oxidation of sulphur to sulphuric acid by *T. thiooxidans* obeys the laws of inorganic catalysis. The transformation of insoluble rock phosphate to soluble phosphates by the sulphuric acid formed from the oxidation of sulphur by *T. thiooxidans* was found to be similar to the process taking place in inorganic reactions.

Report on experimental investigations on the use of aluminum sulphate on alkali land on Reclamation Service projects, C. S. SCOFIELD (*Reclam. Rec.*, [U. S.], 13 (1922), No. 1, pp. 4, 5).—Studies are briefly reported which showed that alkali soils which have become impervious to water due to the presence of gelatinous silicates may be reclaimed by the use of aluminum sulphate. It was found that when applied to an alkaline soil it neutralizes the alkalinity through the formation of an insoluble aluminum silicate, the sodium of sodium silicates uniting with the sulphate of the aluminum sulphate and remaining in solution as a neutral salt, which may be leached out by heavy irrigations.

Applications at the rate of 2 tons per acre showed a very beneficial effect on the permeability of the soil. Where the soil is very fine, such as clay, applications as small as from 2 to 3 tons per acre improved the permeability but did not change the character of the soil as to its hardness on drying. The physical condition of this soil was improved when as much as 10 tons per acre were used. This is taken to indicate that heavy applications of aluminum sulphate have greatly improved the tilth of alkaline clay soils.

Testing fertilizers for Missouri farmers, 1921, F. B. MUMFORD and L. D. HAIGH (*Missouri Sta. Bul.* 192 (1922), pp. 70, fig. 1).—This bulletin contains the guaranteed and actual analyses of 294 samples of fertilizers and fertilizer materials, representing 154 brands, collected for inspection in Missouri during the spring and fall of 1921, together with the results of tests of the power of 897 samples of limestone and similar materials to reduce soil acidity. A list of brands and guaranteed analyses of fertilizers registered and offered for sale in the State for 1922 is also included. The inspection analyses indicate an increase in nitrogen deficiencies over the two previous years and a decrease in deficiencies in total phosphoric acid and potash.

Analyses of commercial fertilizers, fertilizer supplies and home mixtures, 1921, C. S. CATHCART (*New Jersey Stat. Bul.* 358 (1921), pp. 5-55).—

This bulletin reports guaranteed and actual analyses of 692 samples of fertilizers and fertilizer mixtures and home mixtures collected for inspection in New Jersey during the spring of 1921.

Analyses of commercial fertilizers and ground bone, analyses of agricultural lime. C. S. CATHCART (*New Jersey Stat. Bul.* 361 (1921), pp. 5-52).—This bulletin contains guaranteed and actual analyses of 173 samples of fertilizers and fertilizer materials, including ground bone and agricultural lime, collected for inspection in New Jersey during the fall of 1921, together with a brief discussion of the results of the inspection for the entire year.

AGRICULTURAL BOTANY.

The type concept in systematic botany. A. S. HITCHCOCK (*Amer. Jour. Bot.*, 8 (1921), No. 5, pp. 251-255).—Pointing out alleged defects or drawbacks in the Paris code of 1867, the Vienna code of 1905, and the American code of 1907, the last named recognizing the type concept as a fundamental principle, the author claims that the retroactive fixation of nomenclatural types of this code is a fundamental necessity in stabilizing nomenclature. It is thought that while this principle of types is to be accepted, particular rules may be rejected. Illustrations are cited with discussion.

The floral anatomy of the Urticales. A. R. BECHTEL (*Amer. Jour. Bot.*, 8 (1921), No. 8, pp. 386-410, pls. 8).—Study of the anatomy of the flowers of the Urticales reveals a number of features extending throughout the order which are not appreciable from a macroscopic investigation. These features are given in detail.

In plant organs suffering reduction, the vascular system disappears in advance of the organs or persists as abortive bundles after the organs have disappeared.

The combination of primitive and specialized characters makes the Urticales a generalized group, probably not far removed from primitive entomophilous ancestors. Floral anatomy emphasizes the view that the Urticales are a natural order made up of three natural families as classified by Engler.

The natural position of the Ulmaceae, Moraceae, and Urticaceae is at the culmination of a distinct line of descent from a protoangiospermous plexus from which also the Ranalian line descended.

Selective fertilization as an indicator of germinal differences. D. F. JONES (*Science, n. ser.*, 55 (1922), No. 1422, pp. 348, 349).—The author reports observations on the selective fertilization of maize, which is found to offer excellent facilities for this study on account of the large amount of seed produced with one application of pollen and because the source of pollen is so readily determined.

Studies on solanaceous grafts. L. DANIEL (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 22, pp. 1074-1076).—The author has found that potato grafted on plants more or less related gave aerial tubers varying in numbers according to the several plants used as stocks, the tubers being more than usually abundant in the case of eggplant stocks, and most numerous in case of tomato stocks (though showing the influence also of external conditions as well as of stocks). In 1919 he collected the aerial tubers produced by the varieties Fluke and St. Malo, growing respectively on tomato and on eggplant stocks, and planted these tubers in March, 1920. In July it could be seen that the potato plants produced from tubers grown on potato plants grafted on tomato stocks repeated perfectly the earliness and other varietal characters of the parent. Plants from tubers produced by potato plants grafted on eggplant stocks could be divided into two groups with intermediates, the more numerous

of the two retaining the characters of the parent, the other proving to be very late as regards development (retaining its deep green leaves into September, more than a month after the other had lost its foliage) and transmitting partially this habit of lateness during asexual propagation. Further examples of heredity are given, and the significance of the facts is discussed.

A preliminary note on the results of crossing certain varieties of *Nicotiana tabacum*. W. A. SETCHELL, T. H. GOODSPEED, and R. E. CLAUSEN (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 2, pp. 50-56).—In connection with a taxonomic study of the species and varieties of *Nicotiana*, particularly the forms commonly included under *N. tabacum*, a preference was suggested for five type varieties as representative of the range of variation found within the species and possibly of fundamental importance as stem forms in the derivation of other varieties. Attempts somewhat similar (though differing as to the forms to be treated as fundamental) had been made by Comes (E. S. R., 18, p. 440) and by Anastasia (E. S. R., 18, p. 635). The general plan was to determine which few old varieties possessed (in various combinations) all the characters exhibited by commercial varieties, and then to refer existing varieties to hybridization with resulting segregation and recombination. Five such stem forms were selected, and it was planned to determine by experimentation what results would follow their interhybridization. Requiring definite information as to the Mendelian details involved in character differences within the species, three crosses were made (*N. angustifolia* × *macrophylla*, *calycina* × *virginica*, and *alba* × *macrophylla*), all in reciprocal, in 1909, and studied at some length (as far as F_{10} in some cases). Detailed descriptions of the three varieties chosen have been given in a paper by Setchell, previously noted (E. S. R., 28, p. 530). The present paper is restricted to the Mendelian results of these studies.

A general result of these investigations has been a demonstration of the complexity of difference from a genetic standpoint between any two of the so-called fundamental varieties of *N. tabacum*. In one sense this result confirms the opinion of Comes and of Anastasia as to the manner of origin of the vast assemblage of *N. tabacum* varieties. It, however, further demonstrates the futility of seeking to determine affinities on the basis of morphological studies unaccompanied by experimental investigations. The genetic studies here outlined indicate merely that *N. tabacum* is a group species like corn, barley, oats, etc., possessing a complex series of allelomorphic contrasts. The so-called fundamental varieties of *N. tabacum* intercross freely and produce fully fertile progenies. They can not genetically, therefore, be regarded as representing anything but a few very distinct genotypes. The conclusion is considered inevitable that we must regard all our *N. tabacum* varieties as fundamentally equivalent from a genetic standpoint. The really significant problem in considering the species is the determination of how these allelomorphic contrasts have come into existence. These investigations throw no light upon that problem.

The genetics of rogues among culinary peas. W. BATESON and C. PELLEW (*Roy. Soc. [London], Proc., Ser. B*, 91 (1920), No. B 638, pp. 186-195).—Summarizing, with discussion, the results of work done up to the end of 1914, as previously noted (E. S. R., 34, p. 41), the authors detail a continuation of that work extended in several directions but all done with strains of *Pisum sativum* (Sutton Early Giant). It is found that reciprocal crosses between type and rogue give plants which, as they develop, turn into rogues. Though the characters of the type are certainly introduced, manifesting their presence by affecting the form of the young F_1 plant, they very rarely take part in the germ lineage, being apparently left behind in the lower nodes.

Plants really intermediate between type and rogue nevertheless exist, though they never breed even approximately true. Their germ cells may be either type, intermediate (of at least two kinds), or rogue. The proportion of gametes carrying type characters is different on the male and female sides. In both sexes the ratio shows gradational change.

Of the egg cells of the lower flowers, up to about the tenth flowering node, rather more than 50 per cent carry the type characters—or, at least, the non-pointed character—above which level the proportion declines.

Of the pollen in the lowest two flowers, only about 20 per cent is type bearing, and the proportion diminishes rapidly in each successive flower above this level.

Cryoscopic studies on vegetable saps, A. SPRECHER (*Rev. Gen. Bot.*, 33 (1921), No. 385, pp. 11-33).—The author details a study, following up those previously noted (E. S. R., 37, p. 150), regarding osmotic pressures in different plants, including green and mosaic plants of the same species, in particular *Tropaeolum lobbianum* and *T. majus manum*, some forms of which have yellow and others deep red leaves.

It is stated that varieties having mottled, yellow, or deep red leaves show lower osmotic pressure than do those having green leaves. Varieties having deep red foliage show in their sap more residue, yellow and mottled varieties less residue, in relation to osmotic pressure.

Osmotic pressure in *Tropaeolum* shows a diurnal cycle of change, being least in the morning hours, highest in the afternoon, and then lowering gradually to the forenoon minimum.

Between a brown and a yellow variety of *Coleus verschaaffelti* a great difference in osmotic pressure of the sap was found.

Osmotic pressure in the plants showed prompt response to changes in relative humidity of the air, also in heat and illumination. Absence of light produced a diminution of osmotic pressure corresponding naturally to the lowering of assimilation.

No consistent relation was found between size of cells and osmotic pressure. Under identical external conditions, difference in osmotic pressure in the sap of different species is said to be due to chemical action in the cells. It is not in relation with their morphology but is determined by physical and chemical phases.

The properties of colloidal systems.—IV, Reversible gelation in living protoplasm, W. M. BAYLISS (*Roy. Soc. [London], Proc., Ser. B* 91 (1920), No. B 638, pp. 196-201).—An account is given of study employing a modification, which is described, of the usual technique for observing Brownian movement.

It is stated that with intense dark-ground illumination it is possible to see that the apparently clear pseudopodia of *Amoeba* are filled with numerous very minute particles in Brownian movement, thus affording further evidence of the liquid, hydrosol nature of simple protoplasm.

By electrical stimulation, this sol can be reversibly changed into the gel state evidenced by the sudden cessation of the Brownian movement.

Evaporimeters and the movement of fluids in membranes, P. LENAGE (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 19, pp. 927-930).—Concerning a modification of the evaporimeter used in experimentation previously noted (E. S. R., 45, p. 29), the author submits observations and related formulas. Relations noted as between evaporation and positive or negative pressure may, it is thought, be utilized in the study of transpiration and movement of fluids in plants.

A quantitative study of the effect of anions on the permeability of plant cells, II, O. L. RABER (*Amer. Jour. Bot.*, 8 (1921), No. 7, pp. 366-368, fig. 1).—The present paper extends the list of anions employed in work previously

noted (E. S. R., 46, p. 126). The results indicate that the effects upon permeability depend upon the valency of the anion regardless of whether the salts are organic or inorganic.

The effect upon permeability of polyvalent cations in combination with polyvalent anions, O. L. RABER (*Amer. Jour. Bot.*, 8 (1921), No. 8, pp. 382-385, fig. 1).—Bivalent and trivalent cations in combination with monovalent anions produced an increase in the electrical resistance of *Laminaria*, but when combined with bivalent or trivalent anions the increase is less and may be entirely lacking.

The biological significance of alkaloids in plants, G. CIAMICIAN and C. RAVENNA (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 18, pp. 836-839).—Discussing the view that alkaloids are simply refuse products which the plants can not eliminate, but which may serve to protect the plant from alkaloid and other radicals which are more active, the authors state that they have reached the conclusion that both alkaloids and alcoholic radicals tend to augment the injurious action of certain substances present in plants.

While it is true, as stated in work previously noted (E. S. R., 44, p. 222), that substances introduced into a plant by sprinkling or by injection may be eliminated, experimentation, the results of which are cited, shows that certain residual products in the plant are not eliminated but are rendered more resistant to elimination. The effects of organic substances in plants may, it is thought, stand in relation with the resistance which such substances offer to elimination.

The relation of certain nutritive elements to the composition of the oat plant, J. G. DICKSON (*Amer. Jour. Bot.*, 8 (1921), No. 5, pp. 256-274, figs. 2) — The cultural methods employed in growing oat plants under varied nutritive conditions have been detailed in the paper previously noted (E. S. R., 40, p. 324). The results of the present study are given in detail and in tabular and graphical form.

It is stated that the calcium content of both grain and straw is reduced to about 10 per cent of that of the plants from the controls by reducing the calcium in the culture solution to one-tenth the quantity present in the complete nutrient solution. It is greatly reduced in both grain and straw by a similar deficiency in phosphorus or in nitrogen.

The total phosphorus content of the grain is reduced to 46 per cent and that of the straw to 10 per cent of that in the plants from the controls by reducing the phosphate in the culture solution to one-tenth of the quantity present in the complete nutrient solution. It is slightly reduced in both grain and straw by a similar deficiency in potassium, and is increased by a similar reduction of calcium or nitrogen.

Although the variations in composition are more pronounced in the straw, yet in general they are similar in both grain and straw.

The phosphorus content of both grain and straw is modified by seasonal differences, except for the plants grown in the phosphorus-deficient solutions. The calcium content of the grain is modified by seasonal differences even in the calcium-deficient solutions. The calcium content of the straw, however, shows no consistent response to climate.

The influence of luminous rays on a fixer of nitrogen, E. KAYSER (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 20, pp. 969-971).—During a study of the development of *Azotobacter agilis*, exposed to diffused light of different colors from July 1 to October 20 at laboratory temperature, a maximum of nitrogen fixation occurred in the yellow and a minimum in the violet. The disappearance of sugar was only approximately proportional. The results are considered to afford good examples of the effects of irradiation, of the hydro-

carbon nutrient, and of the mass of the organism. Modifying factors may interfere, such as age of the culture, concentration, and temperature.

FIELD CROPS.

[**Report of field crops work at the St. Kitts-Nevis Experiment Stations, 1918-1920**], F. WATTS ET AL. (*West Indies Imp. Dept. Agr., St. Kitts-Nevis Agr. Dept. Rpt., 1918-19, pp. 2-12, 14, 23-27, 28, 29, pl. 1; 1919-20, pp. 2-10, 12, 13, 22-26, 28*).—The progress is reported of experiments along the same general lines as noted previously (E. S. R., 41, p. 825). Work with sugar cane has been described elsewhere (E. S. R., 45, p. 434).

[**Field crops work in Ireland in 1921**] (*Ireland Dept. Agr. and Tech. Instr. Jour., 21 (1921), No. 4, pp. 437-445, 449-476*).—The progress of experiments with various field crops (E. S. R., 45, p. 532) is reported for the year 1921.

[**Report of field crops work in Rhodesia, 1920-21**], H. G. MUNDY, E. E. WRIGHT, and J. H. HAMPTON (*Rhodesia Agr. Jour., 18 (1921), No. 6, pp. 595-599, 604-612, 616-620, pls. 5; 19 (1922), No. 1, pp. 45-52, 68-72, pls. 2*).—These pages report the progress of experiments with field crops at the Salisbury (E. S. R., 45, p. 340), Arlington Sand Veld, and Gwebi Experiment Stations.

[**Report of field crops work in Bengal**], R. S. FINLOW ET AL. (*Bengal Dept. Agr. Rpt. 1920-21, pp. 14, 26-32, 33, 34, 37, 41-43, 49, 50, 52, 54, 55, 57-60, 62, 66-68, 69-72, 75-79, 82, 83, 85, 86, 88-94*).—The continuation of work along the same general lines as noted earlier (E. S. R., 46, p. 131) is reported.

Lime with potash increased the yield of jute on acid red soils, while potash alone had little effect. On the other hand, lime without potash did not inhibit severe attacks of *Rhizoctonia*, which seriously impaired the yield and quality of the crop. Jute plants possessing the longest ultimate fibers have so far shown inferior yields.

G. P. Hector found that many of the characters by which rice varieties differ are inherited in groups or patterns and not independently. In one variety, such gametic relation was found between the color in the ligule of the leaf and the grain color. The ligule color depends on three interacting factors, all necessary for color production, and the grain color depends on the presence of the third ligule factor. Investigations showed that spacing has a large effect on the number of tillers and the number of grains per tiller, but almost none on the date of flowering or on the weight of the individual grains. Neither single seedling transplantation, as opposed to three seedling, nor a month's difference in date of sowing and transplanting had much influence on tillering, on the time of flowering, or on the weight of the individual grain. The number of grains per tiller were affected markedly. Results of transpiration studies indicate that transpiration is a varietal character, that the total water lost is largely dependent on the amount of soil moisture, and that for a given variety the transpiration ratio approximates to a constant for all degrees of saturation.

Fodder crops of western India, H. H. MANN (*Bombay Dept. Agr. Bul. 100 (1920), pp. 230, figs. 2*).—A revised and enlarged edition of the work noted earlier (E. S. R., 37, p. 826).

Practical instructions for the harvesting of wheat, flax, barley, rye, oats, and corn, C. R. TONNELIER (*Bol. Min. Agr. [Argentina], 26 (1921), No. 4, pp. 408-428, figs. 6*).—An account of practices followed in the harvesting of cereals in the several regions of Argentina.

Electrical preservation of stored grass, F. RUTGERS (*Schweiz. Elekt. Ver. Bul. 12 (1921), pp. 216, 217; abs. in Sci. Abs., Sect. B—Elect. Engin., 24 (1921), No. 286, p. 503*).—A patented scheme for the conservation of grass in its mown state without drying is said to have been found successful in practice. The

grass is stored in silos, which are closed at the top and bottom by sheet metal serving as electrodes. Low tension current, generally alternating, is passed through the mass for several days, destroying the organic life of the grass and raising the temperature to such degree that the microorganisms are eliminated. Harvesting is in this way independent of weather conditions, and the preserved grass is said to contain twice the nourishment of an equal quantity of hay.

Studies on the principal vegetable fibers in Japan, K. ISHII (*Bot. Mag. [Tokyo]*, 35 (1921), No. 414, pp. 112, 127-137, figs. 11).—The dimensions and cellulose content of the raw fibers of important Japanese fiber plants are tabulated in an English summary.

A note on poling in some fiber agaves, T. G. M[ASON] (*Agr. News [Barbados]*, 20 (1921), No. 493, p. 84).—The longevity of the plant and the number of years during which a crop can be secured is determined by the time the plant passes in the purely vegetative state before poling and dying. Premature poling is liable to render the culture of the fiber agaves impossible, as the planter is not allowed sufficient time to recover the capital expended. Leaves of sisal propagated by bulbils in Montserrat in September, 1902, were ready for harvesting in two years, instead of the four years normally required. In 1907, 25 per cent of the plants had poled and the whole life cycle was apparently accelerated. However, four crops were secured before the plants were removed. The need is indicated of investigations to determine the factors responsible for premature poling.

Alfalfa experiment, M. A. BEESON, A. DAANE, and D. R. JOHNSON (*Oklahoma Sta. Bul.* 188 (1921), pp. 18, figs. 3).—Alfalfa, receiving manure at the rate of 12 tons per acre in 1913, produced during the period 1915-1920 more than twice the crop returned by an untreated plat. Limestone applied after the first cutting in 1916 gave a substantial increase over the check plat except in the first year. Where both lime and manure were used, still more alfalfa was produced than with manure alone. After the second year, the untreated alfalfa began to die or was crowded out by weeds, whereas plats manured and limed retained a good thrifty stand.

In a fertilizer test on bottom land, alfalfa receiving barnyard manure returned 0.25 to 2 tons more hay per acre than plats with commercial fertilizers alone. Phosphorus as steamed bone meal effected a greater increase than potassium sulphate, dried blood, or lime.

Alfalfa seeded with a 7-in. drill averaged 4,828 lbs. per acre per season during a 6-year period, while plats seeded in 42-in. rows and cultivated from 2 to 4 times each season made 4,188 lbs. The hay from the drilled plats was usually of better quality and contained less sand and dirt.

Analyses of samples of alfalfa seed from 1912 to 1920 disclosed in order of occurrence the presence of foxtail, prostrate amaranth, rough pigweed, paspalum, crab grass, economic seeds, lamb's-quarters, barnyard grass, old witch grass, panicum, Russian thistle, dodder, and rib grass.

Cultural methods for hay and pasture are outlined in brief.

Alfalfa culture, C. T. AMES (*Mississippi Sta. Circ.* 43 (1921), pp. 4).—Cultural and field practices deemed best for growing the crop on the brown loam (Memphis silt loam) soils in the State are outlined.

Alfalfa hybridization, W. SOUTHWORTH (*Sci. Agr.*, 2 (1922), No. 8, pp. 257-264, figs. 6).—The technique in alfalfa hybridization studies at the agricultural colleges of Ontario and Manitoba is detailed with a discussion of conditions favorable for cross-fertilization. In revising an earlier conclusion (E. S. R., 31, p. 831) based on work in Ontario, it is stated "that when similar tests are conducted in Manitoba quite an appreciable amount of seed is obtained from flowers which have not been selfed artificially nor visited by bees."

Corn growing in New Jersey, G. W. MUSGRAVE (*New Jersey Stat. Circ.* 128 (1921), pp. 22, figs. 14).—This circular comprises practical instructions for the production of corn in the State, and treats of varieties and strains, selection, preservation and testing of seed, cultural and improvement methods, and the acre cost of production.

Corn culture in Argentina, C. D. GIROLA (*Pub. Mus. Agr. [Soc. Rural Argentina]*, No. 26 (1921), pp. 24, pls. 2, figs. 6; also in *An. Soc. Rural Argentina*, 55 (1921), No. 24, pp. 886-909, pls. 2, figs. 6).—Information concerning the culture of corn in Argentina is presented with varietal descriptions and the details of a corn-growing contest conducted in 1920.

The chief causes of low yields of maize in the Union [of South Africa], G. J. BOSMAN (*Union So. Africa Dept. Agr. Jour.*, 3 (1921), No. 6, pp. 507-514).—Irregular and often insufficient rainfall, infertile soil, improper seed bed preparation, poor seed, lack of crop rotation, growing corn in unsuitable areas and using wrong varieties in suitable areas, wrong cultural methods, and shortage of labor are enumerated and discussed as some of the main factors contributing toward low yields of corn in the country.

Genetic evidence of aberrant chromosome behavior in maize endosperm, R. A. EMERSON (*Amer. Jour. Bot.*, 8 (1921), No. 8, pp. 411-424, fig. 1).—This contribution from the department of plant breeding, Cornell University, cites data showing that when aberrant seeds occur in crosses in which recessive aleurone and endosperm characters are contributed by the female parent and the corresponding dominant characters by the male parent, spots of the recessive (♀) aleurone color are in most cases overlaid by the recessive (♀) type of endosperm if the genes for this aleurone and endosperm characters are genetically linked, as shown by breeding tests. On the other hand, recessive aleurone-color spots are always, so far as observed, overlaid by the dominant (♂) type of endosperm, and recessive endosperm parts are overlaid by the dominant aleurone color if the aleurone-color and endosperm-composition genes are not linked. These facts are held to support the hypothesis of occasional aberrant chromosome behavior, possibly nondisjunction, and are considered to be incompatible with the earlier hypotheses involving failure of normal fusion of the second sperm nucleus with the polar nuclei, and also to make untenable, except in rare cases, the hypothesis of somatic mutation.

A treatment to preserve valuable representative samples of ear corn, C. S. DORCHESTER (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 3, pp. 93-95).—The farm crops department of the Iowa State College found that a transparent, rather glassy coating, which protects against the Angoumois grain moth, discourages mice, and helps to prevent the shelling of butt and tip kernels can be secured by dipping corn ears in pure white shellac. The shellac not only protects and thereby greatly lengthens the life of a sample, but is said to actually improve the appearance of the corn.

Spinning tests to compare middling yellow stained cotton with middling yellow stained bolly cotton, D. E. EARLE and H. B. RICHARDSON (*Cotton*, 86 (1922), No. 6, p. 401).—A bale of middling yellow stained cotton was compared under identical conditions for wastiness and tensile strength with a bale of middling yellow stained bolly (E. S. R., 31, p. 832; 40, p. 366) cotton of equal (1-in.) staple, in a test by the Bureau of Markets and Crop Estimates, U. S. D. A. The bolly cotton was found to be 5.27 per cent more wasteful and to average about 10 per cent weaker than the bale of equal grade.

Nep, T. G. MASON (*Agr. News [Barbados]*, 20 (1921), No. 489, p. 22).—The life history of the cotton-lint hair, as worked out by Balls (E. S. R., 35, p. 230), is outlined, and the factors responsible for the presence of nep are considered.

The author admits that the prospects of reducing the amount of nep are not promising under ordinary conditions, and suggests the culture of strains such as developed by Harland in St. Vincent and characterized by an extremely low rate of boll shedding. If these were planted so that maximum boll production took place in the drier months, the deposit of secondary cellulose might be expected to proceed uniformly. The recognition and elimination of strains possessing an abnormal amount of slabby fibers is considered the most promising method of reducing the amount of nep.

Seed studies with Irish potatoes, J. T. Rosa, JR. (*Missouri Sta. Bul.* 191 (1922), pp. 32, figs. 5).—The experiments reported were conducted during 1918 to 1920, inclusive, on Knox silt loam soil of medium productivity, and in 1921 on Putnam silt loam of low productivity.

Four years' tests of varieties and varietal strains show that only Early Ohio and Irish Cobbler are well adapted for the early spring crop in Missouri, surpassing other early sorts both in total yield and production of No. 1 tubers. Standard late varieties gave poor yields, and a group of late sorts designated as special "fall croppers" made practically nothing when planted for the spring crop. Real Irish, a local variety, Green Mountain, McCormick, Banner, and Peachblow produced the best yields of the varieties planted for the fall crop. Planting Early Ohio and Irish Cobbler for the fall crop seems warranted only for the production of seed for the following spring crop.

Seed storage tests indicate that northern-grown seed potatoes intended for planting the fall crop should be placed in cold storage in March. Fall home-grown potatoes intended for this purpose should be held in ordinary cellar storage until April 1, and then kept in cold storage at 35 to 45° F. until July. For the spring crop, spring home-grown potatoes were much inferior to northern potatoes, yielding less and with a higher percentage of culls, whereas fall home-grown potatoes of the early varieties closely approached northern grown seed. The very high percentage of culls produced by the spring home-grown seed and the very low percentage produced by the fall home-grown seed were notable in all the experiments.

Comparisons of different lots of the leading early varieties revealed a wide range in productivity within the clonal group or variety, and a general tendency for the various strains to retain their relative positions in the tests from year to year.

The practice of greening and sprouting seed potatoes, which has generally reduced the yield, is not considered profitable. When cut seed pieces were used, the greening and sprouting treatment did not affect very markedly the number of stalks per hill, but resulted in a slight decrease in the number of tubers per hill and a decided decrease in average weight of tubers. With small, whole tubers, the number of stalks and the number of tubers per hill increased in the sprouted lots, but the average weight of the tubers decreased.

Trials with cut pieces and whole seed indicate that under ordinary growing conditions in Missouri the most profitable size of seed piece for the Early Ohio Variety is not much beyond 1 oz. The total yield increased with the size of seed piece planted, but the increase diminished with each increase in size. The production of No. 1 grade increased considerably from the 20-gm. to the 30-gm. seed pieces, but little or no increase appeared above this size.

The growth characteristics of plants from different sizes of seed were such as to probably result in different crop returns under varied conditions. The number of stalks and average number of tubers per hill increased with the size of the seed, but the average weight of tubers decreased. Whole-tuber seed pieces produced more stalks and a greater number of tubers per hill than cut seed of equal size. The average number of tubers per stalk tends to be a

varietal characteristic but may be largely affected by soil and weather conditions.

Seed potatoes for better yields, J. T. ROSA, JR. (*Missouri Sta. Circ.* 106 (1922), pp. 8, figs. 3).—A popular abridgement of the above.

Irrigation as a factor in seed potato production, H. O. WERNER (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 133-137).—Data are presented indicating that the conditions produced by irrigation as practiced in the West have a very deleterious effect upon tubers for seed purposes, manifest after the first season. Dry-land grown seed potatoes are distinctly superior. Irrigation is the only factor considered responsible for the differences secured, as marked degeneration may take place without the prevalence of any diseases known at present. These and previous results show that fundamental tuber unit studies with potatoes can throw little light on the fundamental principle of tuber line selection, unless carried on where atmospheric, soil, and moisture conditions are all satisfactory for the normal development of potatoes.

Report of the International Potato Conference, 1921, W. R. DYKES (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt.*, 1921, pp. 182, pls. 5, figs. 37).—This reports the proceedings of the conference held in London November 16, 17, and 18, 1921. Among the papers presented were the following: Potato Breeding, Selection, and Seed Development Work in the United States, by W. Stuart; Breeding, Selection, and Development Work in Britain, by W. Robb; Bud Variation, by D. MacKelvie; Potato Breeding, Selection, and Development Work in the British Isles, by F. J. Chittenden; The Early-Potato Industry, by J. M. Hannah; and The Industrial and Commercial Uses of the Potato, by H. V. Taylor.

Variation and correlation of characters among rice varieties, with special reference to breeding, T. VIBAR (*Philippine Agr.*, 10 (1921), No. 3, pp. 93-104).—Agronomic and yield data were secured on 100 plants of each of 16 upland and 69 lowland varieties of rice in the studies reported.

The author found decided correlations to exist between yields and days to maturity, and between days to maturity and length of longest leaves, and weight of straw; marked correlations between yield and length of culm, length of panicle, number of nodes in panicle, and length of grains; and slight correlations between yield and number of spikes per panicle, width of leaves, length of leaves, and weight of straw; and between days to maturity and length of culms, length of panicles, number of nodes per panicle, width of leaves, and length of grains. No correlations were apparent between yield and width of grains; nor between days to maturity and number of spikes per panicle, and width of grains. The results obtained are said to substantiate those of Jacobson (*E. S. R.*, 36, p. 531) on the relation of yield to days to maturity, length of culm, and length of grains.

Inheritance of glume color in rice, Y. YAMAGUCHI (*Bot. Mag. [Tokyo]*, 35 (1921), No. 414, pp. 106-112).—In studying the mode of inheritance of glume color in rice, crosses were made between Karasumoti, a race with a dextrinous endosperm characterized by dark blackish violet glumes, and Sinriki, a race with a starchy endosperm and yellowish white glumes. The genetic relations between the endosperm characters have been reported in an earlier contribution (*E. S. R.*, 40, 632).

The reciprocal crosses gave F_1 individuals with blackish violet glumes lighter in color than Karasumoti. In the F_2 , segregation took place in a blackish violet (*A*), blackish violet at the extremities of each glume (*B*), brownish red (*C*), brownish red at extremities of each glume (*D*), and yellowish white (*E*), in the ratio of 27:9:9:3:16. A thorough examination of the F_4 descendants showed the existence of 7 different types in *A* as follows: Constant *A*, and others segre-

gating approximately in $A:E=3:1$; $A:B:E=9:3:4$; $A:C=3:1$; $A:B:C:D=9:3:3:1$; $A:C:E=9:3:4$; and the trifactorial equivalent to the F_1 , $A:B:C:D:E=27:9:9:3:16$. Among the progeny of B , the 4 types observed were constant B ; and types segregating into $B:E=3:1$; $B:D=3:1$; and $B:D:E=9:3:4$. The descendants of C included constant C ; and types segregating approximately into $C:D=3:1$; $C:E=3:1$; and $C:D:E=9:3:4$, and finally among the descendants of D were constant D , and a type segregating into $D:E=3:1$.

A relation of "repulsion" apparently exists between the factor for color and those for the character of the endosperm. The colored types, especially those with dark blackish violet glumes, are in a relation of absolute repulsion with the starchy endosperm, while those with yellowish-white glumes are in like relation (although partially) with the dextrinous endosperm. Although the data on this question are not yet completed, it is indicated "that there is an intimate relation between the formation of the dark blackish violet pigment and the formation of the dextrinous endosperm. The pigment evidently belongs to the class of anthocyanins none other than the glucosids; the chromogen to which the anthocyanin owes its origin will be perhaps a product of the synthesis of sugar, whereas the amyloextrin or the erythroextrin, which is present in the endosperm of rice and the chemical constitution of which is less complicated than that of starch . . . may be a transitory substance in the course of the synthetic formation of starch at the expense of sugar."

Rice culture in Rio Grande do Sul [Brazil], A. T. FILHO (*Min. Agr., Indus. e Com., Dir. Serr. Insp. e Fomento Agr. [Brazil] Bol. 1 (1921), pp. 43, pls. 4, figs. 12*).—A general account of the practices followed in rice production in the State of Rio Grande do Sul.

Preliminary report on sugar beets in Louisiana, C. E. COATES and A. F. KIDDER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 213, 214).—A series of results show the possibility of growing sugar beets of high sucrose content and high purity in Louisiana and of obtaining heavy yields. The best results are obtained by late spring planting. The yields average 18 tons per acre, the purities about 85, and the sucrose 14 per cent. The use of beet seed of high quality is considered an essential feature.

Composition of wild beets, E. SAILLARD (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 6, pp. 411, 412).—The fact that wild beets from Finistère, France, exhibited a richness in sugar equal to cultivated types is held to indicate a source of breeding material rather than lack of confidence in selection.

The possibilities of the Java seedling canes in Louisiana, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 11 (1921), No. 9-10, pp. 118-121; also in *Internatl. Sugar Jour.*, 23 (1921), No. 275, pp. 614-616).—Based on his experience in Louisiana from 1910 to 1914, and on his work with Java seedling canes in Tucumán from 1914 to 1921, inclusive, the author recommends the Java seedling canes POJ 36 and POJ 213 for Louisiana. Their qualities comprise a vigorous ratooning power which gives heavy acre yields of cane, low cost of cultivation on account of rapid spring growth, high resistance to the cane-borer (*Diatraea saccharalis*), greater resistance to frost damage, root disease, and the mosaic disease than exhibited by the Cheribon cane and D 74, and greater resistance to the rotting of the stubble during winter. The Java seedling canes contain an average of 12.5 per cent fiber as compared with 10 to 10.5 for Cheribon. With a high fiber cane it is possible to obtain a higher sucrose extraction with the same mill, while the greater quantity of bagasse obtained per ton of cane enables the factory to eliminate the additional fuel expense.

Sunflower studies, P. V. CARDON (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 3, pp. 69-72, pls. 3).—The author describes and illustrates 10 different types distinguished among plants of Mammoth Russian sunflowers at the Montana Experiment Station and the Huntley Substation, and reports observations on the effect of bagging sunflower heads (*E. S. R.*, 46, p. 327).

The sweet potato for south Mississippi, E. B. FERRIS and F. B. RICHARDSON (*Mississippi Sta. Bul.* 206 (1921), pp. 3-20).—Practical information, based on results of experiments at the McNeill and South Mississippi Substations, is given regarding the most profitable varieties of sweet potatoes and their soil, climatic, and fertilizer requirements. Cultural, harvesting, storage, and marketing practices are detailed, with notes on insects and diseases.

Some methods of recording data in timothy breeding, M. W. EVANS (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 3, pp. 62-69, fig. 1).—Certain methods of obtaining records employed in connection with timothy breeding experiments, conducted cooperatively by the U. S. Department of Agriculture and the Ohio Experiment Station at Elyria, Ohio, are described to illustrate the advantage of substituting quantitative data for the mere results of general observations.

The use of certain definitions describing timothy plants in different stages of bloom and maturity made possible the obtaining of accurate records of the time when the plants of different selections or varieties of timothy are in bloom and mature. A system of counting the number of leaves with partially or entirely green blades has been developed, by which the relative number of green leaves, per unit of area on different dates in broadcast plats of different kinds of timothy, can be accurately determined. By measuring the longest stem of each plant growing in cultivated row plats of different selections or varieties of timothy, data may be obtained which show not only the relative length of the stems of the plants in the different plats, but also the relative degree of uniformity in the lengths of the stems of plants in these plats.

A comparative study of winter wheat varieties with especial reference to winterkilling, R. NEWTON (*Jour. Agr. Sci. [England]*, 12 (1922), No. 1, pp. 1-19).—Minhardi and Buffum, hardy varieties, and Turkey and Kanred, tender varieties of winter wheat, were collected at the University of Minnesota when frozen solid and compared in the hardened condition as to the physical constants of the cell sap and the content of dry matter, nitrogen, sugars, and starch.

No constant relation was found between depression of the freezing point, specific conductivity, or H-ion concentration of the cell sap and relative frost hardness. Sugars accounted for 34 to 38 per cent of the total osmotic pressure of the sap. The ratio of that part of the osmotic pressure not due to sugars (i. e. $P - P_s$) to the corrected specific conductivity ($\times 10^6$) is not a constant. For samples collected November 12, this ratio varied from 0.96 to 1.07, averaging 1, and for those collected December 9, from 0.73 to 0.91, averaging 0.8. The relation between dry matter content and hardness was not constant, although Kanred had the lowest percentage of dry matter.

All varieties increased in amino nitrogen and water-soluble nitrogen during the hardening process. The hardest variety had the largest content of water-soluble nitrogen, but the relation was not uniform throughout the series. The sugar content did not correspond uniformly with the known hardness. The percentage decreased between November 12 and December 9, falling lowest in Kanred. Sucrose was apparently the only disaccharid present, and all varieties were entirely free from starch.

The colloidal complex of the cell of the fully hardened tissue could not be broken down by exposure to the temperature of a calcium chlorid-snow cryohydric mixture ($= -54.9^\circ \text{C.}$). From tissue containing about 70 per cent

of moisture no appreciable amount of sap could be expressed by 400 atmospheres' pressure, even after severe preliminary freezing.

The preparation of seed by immersion in nutritive solutions, E. MANCINI (*Italia Agr.*, 58 (1921), No. 12, pp. 379-383).—Seed corn immersed for different periods in solutions of ammonium nitrate, potassium nitrate, ammonium sulphate of several concentrations, and in water alone, was compared with untreated seed. The seed immersed in the nutritive solution was found to possess a lessened germinability, particularly when the solution was over 6 or 8 per cent concentration and when the duration of treatment was longer than 12 or 14 hours. The treated seed exhibited an increase in germinative energy as compared with seed not treated, but this was not considered dependent on the special stimulation of the embryo by the solution. The seed still contained a certain quantity of water which favored the premature development of the germ. Plant production was not affected.

The seeds regulations (Ireland), 1921 (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1921), No. 4, pp. 495-504).—These regulations, effective September 7, 1921, concern transactions in field, garden, and forest tree seeds in Ireland under the Seeds Act, 1920 (E. S. R., 45, p. 833).

Standards of purity and germination prescribed for seed oats, barley, rye, and wheat, F. F. COLEMAN (*Queensland Agr. Jour.*, 17 (1922), No. 3, pp. 91-93).—The standards prescribed by the regulations under the Pure Seeds Act are given, with information concerning the purity and germination of samples examined at the Queensland departmental seed laboratory during 1921.

Newly recorded weeds, W. F. BLAKELY (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 1, p. 6).—New weeds recorded at the National Herbarium at Sydney include *Chenopodium vulvaria*, *Sisymbrium sophia*, and *Centaurea piciis*.

Water hyacinth: A serious pest in Bengal, K. McLEAN (*Agr. Jour. India*, 17 (1922), No. 1, pp. 23-40, pls. 2).—The life history of the plant is outlined, and control operations in Bengal, Burma, Cochin China, Australia, and the United States are described. Practical suggestions are given for the collection, destruction, and utilization of the weed.

HORTICULTURE.

Horticulture as a science, H. D. HOOKER, JR. (*Science*, n. ser., 55 (1922), No. 1424, pp. 384-388).—In this paper, presented before the Association of Southern Agricultural Workers at Atlanta, Ga., on February 21, 1922, the author, noting the trend on the part of horticultural investigation toward the solution of more fundamental problems than have been considered in the past, emphasizes the dependence of horticultural on other branches of science and urges investigators to keep an open mind toward progress in other fields. It is believed that the older idea of solving a complex problem by a single mass attack must yield to specific study of the various component problems. The futility of the old method is illustrated by pointing out the multiplicity of apple fertilization studies in the past and the resulting failure to bring forth any universal principles.

The ripening of California plums, H. C. DIEHL and J. R. MAGNESS (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 4, pp. 387-392).—This contribution from the U. S. D. A. Bureau of Plant Industry presents the results of a single season's study of the relation existing between the stage of maturity of California plums at the time of harvest and their quality when attaining an edible condition.

For the purpose of the study, fruit of Wickson and Grand Duke obtained at regular intervals from selected trees in orchards near Vacaville and Santa Clara, Calif., was shipped to Watsonville, Calif., where a part of each lot was

submitted to chemical analyses and the balance placed in three cold storage compartments maintained at approximately 30, 37, and 60° F. The experimental fruit was harvested prior to, during, and after the commercial season. The time required in transporting the fruit from the orchard to storage at Watsonville was usually less than two days.

The results of chemical studies, presented in tabular form, including sugar, acid, and dry weight determinations, show a marked tendency for the sugars and total dry matter to increase with the advancement of the season and a corresponding tendency for a decrease in acid content. Fruits gathered at the height of the commercial season attained satisfactory color and juice, but lacked somewhat in flavor as compared with those gathered later. It was found that fruits destined for cold storage should be allowed to remain on the tree for a longer period than those destined for shipment. Fruit kept satisfactorily for from 4 to 6 weeks when held at 32 and 37°, but after this period decayed very rapidly. As a whole it is believed the studies indicate that unquestionably a considerable quantity of California plums is harvested too early to insure proper quality when reaching distant markets.

Compound fruits in the peach resulting from multiple pistils, R. E. KAPER (*Jour. Heredity*, 12 (1921), No. 9, pp. 402-406, figs. 3).—Phenomenal development of peach fruits, observed at the Lubbock, Tex., Substation in the summer of 1919, was manifested in a high percentage of multiple fruits in most all the varieties grown. A tabulation included in the text shows as high as 98 per cent abnormal fruits for trees of some varieties, and so numerous were these off-type fruits that in many cases normal specimens were the notable exception to the rule. This unusual condition is believed to have been caused by a combination of factors—unusually favorable weather following a long period of adverse conditions with consequent nonfruiting. Certain varieties which had borne a small crop in 1918 were much less seriously affected, and in two instances produced all normal fruit.

Grapes in Mississippi, J. C. C. PRICE (*Mississippi Sta. Circ.* 44 (1921), pp. 4, figs. 3).—Brief information is given relative to the character and behavior of seven varieties of northern grapes growing on the station grounds, including data relative to yields in 1920 and 1921 and data on the value of spraying as a means of control for fungus and insect pests. It is recommended that all leaves showing phylloxera galls be clipped from the vines and burned as a precautionary measure.

The olive in Arizona, F. J. CRIDER (*Arizona Sta. Bul.* 94 (1922), pp. 489-528, figs. 20).—A presentation of information relative to olive production in Arizona, based on investigations conducted by the station during the past 26 years and on observations in commercial orchards. Among the various factors considered are soil, temperature, propagation, grafting, planting, culture, pruning, harvesting, and grading. Descriptive data are given for the fruit and trees of 17 varieties growing on the university campus. Information is also given relative to the pickling of the fruits and to the future of the industry. "Apparently the greatest possibilities in this industry lie in the production of ripe olives, with oil as a major by-product."

The Andes berry, W. POPENOE (*Jour. Heredity*, 12 (1921), No. 9, pp. 286-393, figs. 4).—With plant characters resembling the black raspberry and with fruit similar to the blackberry, this species, *Rubus glaucus*, growing over a wide range from southern Mexico to Peru, is deemed of value on account of the vigor of the plant and the large size and good quality of fruits. Although unable to withstand the winters at Washington, D. C., it is thought that the berry may succeed on the Pacific coast and extreme Southwestern States. Its possible value as a plant breeding material is also suggested.

The banana, W. RUSCHMANN (*Tropenpflanzer, Beiheft, 20 (1920), No. 1-2, pp. 68, figs. 11*).—A discussion of the banana industry with reference to its extent and importance, use for human and animal food, the principal banana-producing countries, and the possibility of developing the industry in the Kamerun with the view of supplying the needs of the German people from a territory which was formerly one of the German colonies.

The Swazey barberry, F. T. RAMSEY (*Jour. Heredity, 12 (1921), No. 9, pp. 426, 427, fig. 1*).—This is a brief descriptive account of a barberry species growing naturally in western Texas, which on account of the beauty of the foliage and the edibility of the fruit is considered worthy of use as a cultivated shrub.

The amateur's book of the dahlia, MRS. C. H. STOUT (*Garden City, N. Y., and Toronto: Doubleday, Page & Co., 1922, pp. XX+314, pls. 8, figs. 7*).—A popular text discussing, among other subjects, the history, breeding, propagation, culture, and classification of the dahlia.

FORESTRY.

Reports of the Maryland State Board of Forestry for 1918-1919 and 1920-1921, F. W. BESSEY ET AL. (*Md. State Bd. Forestry Rpts., 1918-1919, pp. 60, pls. 8; 1920-1921, pp. 68, pls. 9*).—These are the usual biennial reports (*E. S. R.*, 39, p. 50), covering the four years 1918-1921. In addition to the customary data relative to fire protection, State forest nurseries, State forests, etc., the first report presents data on tests with loblolly pine conducted at several Maryland points in order to determine the possibility of extending the range of the species, learning the best method of seeding, and obtaining information relative to the rate and manner of growth in plantations. The results indicated that loblolly pine not only can be grown in the scrub pine areas of Maryland but also makes a much more rapid and desirable growth than the latter species. A sufficient stand of young loblolly pines was obtained by broadcasting 5 lbs. of seed per acre on land prepared by one careful cultivation with a spiked tooth harrow.

Annual report of the Crown Land Department of the Province of New Brunswick for the year ended October 31, 1921 (*New Brunswick Crown Land Dept. Ann. Rpt., 61 (1921), pp. 87, pls. 8, fig. 1*).—Like those of preceding annual periods (*E. S. R.*, 45, p. 349), this report comprises the usual administrative and fiscal statements, with subreports relative to game protection, mining activities, forest survey, spruce budworm survey, fire protection, etc. During the year 867,108 acres of Crown land were estimated and mapped, bringing the total examined to 53 per cent of the entire area. Tabular data are included showing the growth and yield of black and white spruce, balsam fir, and other woods on the Bathurst area.

New Zealand State Forest Service report for the year ended March 31, 1921, L. M. ELLIS ET AL. (*New Zeal. State Forest Serv. Rpt. 1921, pp. 20, pls. 4, figs. 4*).—This is the initial report of the recently created State Forest Service and is devoted for the most part to a discussion of the organization and proposed activities. During the year negotiations were practically completed for the acquisition of 908 acres of kauri forests near Dargaville. This area is described as the last remnant of the original forest of northern New Zealand.

Forest mapping and estimating from aerial photographs, E. WILSON (*Jour. Forestry, 20 (1922), No. 2, pp. 113-116, fig. 1*).—A descriptive account of an aerial forest survey in which, notwithstanding that only 12.8 hours were actually spent in photographic work, a total of 140 square miles were mapped. Although the airplane was maintained at an elevation of 5,000 ft., sufficient detail was obtained to allow proper interpretation of the results.

A new method of measuring tree heights on sample plats, H. KRAUCH (*Jour. Forestry*, 20 (1922), No. 3, pp. 220-222).—Directing attention to the difficulty attending the remeasurement of forest trees in sample plats according to the old method of recording height, namely, by laying off a horizontal base line of 100 ft. from each individual tree, the author describes an improved method whereby the instrument can be set up in any advantageous position in respect to a maximum number of trees. In this case the distance need not be exactly 100 ft., the true value of the height readings being computed by multiplying the actual reading by the distance of the instrument from the tree and pointing off two places from the right on the product. With proper staking and with careful notation of distances in the field book no great difficulty is encountered in reestablishing the original base. This new method is deemed superior in that many readings can be taken from the same point, the original base can be easily relocated, and much time can be saved, since the horizontal distances between the instruments and the trees need not be determined except at the original observation.

Rate of growth of Bengal sal (*Shorea robusta*) I quality, S. H. HOWARD ([*Indian*] *Forest Bul.* 46 (1921), pp. 16, pls. 8).—In addition to discussion and detailed tabular data, the results of this study are graphically shown in the form of seven curves illustrating correlation between bark thickness and diameter, taper curves showing the relation between stump and breast height, diameter to age, diameter of heartwood, length of merchantable bole for different ages, volume to age, and thickness of bark for a given diameter.

Notes on release of white pine in Harvard Forest, Petersham, Mass., J. N. SPAETH (*Jour. Forestry*, 20 (1922), No. 2, pp. 117-121).—Observations on natural regeneration on abandoned agricultural and pasture lands in central New England showed that the gray birch, aspen, and red maple, usually springing up simultaneously with white pine, often succeed in completely suppressing this desirable species during the first 30 years of the life of the stand. This paper is a preliminary report on an experiment begun in the Harvard Forest in 1915 to study the effect on white pine of the early removal of the hard woods.

The pines on two contiguous quarter-acre plats were carefully described, labeled, and calipered, and from one of the plats designated as "release" all the hardwoods were removed. Data obtained in January, 1921, after five seasons' growth showed that 28 per cent of the release plat trees had improved and an equal number had declined in vigor. On the other hand, only 3 per cent of the control trees had improved, whereas 83 per cent had declined. It is pointed out that from a biological viewpoint the most desirable age for removing hard woods is dependent upon the intensity of the struggle between the two types in the stand. Site is also a factor in that on rich loamy soils favorable to the development of hard woods these species will practically eliminate white pine, while on sandy soils the pines may persist until the maturity of the birch.

The author believes that for average conditions in central New England the period during which disengagement cuttings are possible is approximately from the tenth to the twenty-fifth year of the life of the stand. The most profitable age is, however, between the eighteenth and twentieth years, which is the minimum age at which hard woods may be converted into a merchantable product.

Malayan forest records.—I, Commercial woods of the Malay Peninsula, F. W. FOXWORTHY (*Malayan Sci. Bul.* 1 (1921), pp. 150).—This paper includes a comprehensive discussion of the more important native and imported com-

mercial woods used in the Malay Peninsula with particular attention to their special uses and distinguishing characteristics.

Note on the miscellaneous forests of the Kumaon Bhabar, E. A. SMYTHIES ([*Indian*] *Forest Bul.* 45 (1921), pp. 22, pls. 7).—Information is presented relative to the nature and extent of the mixed Bhabar forests located in the foothills of the Himalayas. Among the points discussed are present methods of management and potential possibilities in exploitation. A list is appended of the principal trees and shrubs growing in these forests.

Note on *Odina wodier* Robx., C. E. C. COX ([*Indian*] *Forest Bul.* 43 (1921), pp. 21, pl. 1).—In addition to a general statement relative to the distribution and description of the tree, manner of regeneration, description and characteristics of the timber, and manufactured products and their uses, there is included a detailed statement, arranged by provinces, of the chief sources of supply of this timber. A veneer specimen of the wood accompanies the pamphlet.

Note on *haldu* (*Adina cordifolia* Hook. f.), C. E. C. COX ([*Indian*] *Forest Bul.* 42 (1921), pp. 23, pl. 1).—Presented in a similar manner to the above.

Note on *semal* or cottonwood, C. E. C. COX ([*Indian*] *Forest Bul.* 44 (1921), pp. 31, pl. 1).—Presented in a similar manner to the above.

DISEASES OF PLANTS.

The Imperial Bureau of Mycology, E. J. BUTLER (*Brit. Mycol. Soc. Trans.*, 7 (1921), pt. 3, pp. 168-172).—A brief account is given of the movement which led to the establishment of the bureau, with a brief sketch of its proposed activities, the latter including the accumulation and distribution of information on matters concerning fungus diseases of plants of interest to workers; the publication of a periodical abstract journal; the formation of a reference library, especially of original papers in reprint form to be available for issue on loan; the organization of a system for securing reasonably prompt identification of injurious fungi; the critical study of parasitic fungi at present in a state of confusion, and the arrangement of facilities for supplying authentically named cultures to workers elsewhere; the formation of a working herbarium of parasitic fungi, with larger specimens and photographs illustrating diseases elsewhere, and the supply of named collections to other institutes and individuals; the provision of laboratory facilities for overseas workers; the organization of a central agency from which timely information can be supplied on such matters as legislation against fungus plant diseases and recent progress in methods of control; and the stimulation of the study of other branches of applied mycology.

Recent literature on fungus diseases of plants, L. H. PAMMEL (*Iowa State Hort. Soc. Trans.*, 54 (1919), pp. 104-161).—The author gives an account, classified as previously (*E. S. R.*, 42, p. 541) according to the plants required to be protected, of diseases and control measures. A biographical and bibliographical section includes brief discussion of the lives and work of deceased pathologists and mycologists, and enumeration of a few related publications and activities.

[Plant diseases, France, 1919-20], P. MARCHAL, E. FOEX, and P. VAYSSIÈRE (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. XXXV-LXXXVII).—This portion of the report deals primarily with the meteorological relations of economic plant diseases as they occurred in the years 1919 and 1920, which are considered separately.

Disease in plants, A. HOWARD (*Agr. Jour. India*, 16 (1921), No. 6, pp. 626-637, pls. 2, figs. 2).—The author furnishes illustrations and information in a

discussion of rust (also green fly) of wheat, red rot of sugar cane, and various wilt diseases in Bihar.

[**Plant diseases, East Africa**], W. J. DOWSON (*Brit. East Africa Dept. Agr. Ann. Rpt. 1917-18, pp. 123-140*).—The mycologist's report for the year ended March 31, 1918, states that during the early part of this period humidity greatly favored disease injury to plants.

Sisal, previously regarded as highly resistant or immune to fungus diseases, has recently shown susceptibility to attacks by both bacteria and a parasitic fungus. Red blotch, producing unsightly appearance and shortening the fiber, is physiological and without remedy to date. A yellow gumming blotch, apparently bacterial, has recently appeared. A leaf spot is ascribed to an accompanying *Colletotrichum*.

Maize rust (*Puccinia sorghi*) increased and caused much damage. A severe bacterial rot affecting stems or leaves (usually not both) of young plants gives off in the late stages an odor recalling coconut bud rot. Certain white varieties showed a white and a yellow cob rot due to various mold fungi. Yellow varieties have proved resistant and productive.

Serious diseases in forest plantations affected species of *Eucalyptus*, *Araucaria*, and *Brachylaena*, the last named showing a *Sclerotinia*.

Coffee shows (according to altitude, culture, and variety) a wide variation as regards injury from *Hemileia vastatrix*. Leaf and berry spot disease (*Cercospora coffeicola*) has spread considerably since its first recorded appearance in 1913. Both diseases yield readily to a Bordeaux spray, 2 lbs. copper sulphate to 40 gal. water, which is also found to prevent the spread of a new stem disease ascribed to a species of *Phoma*. A leaf curl, associated with brittleness and yielding a *Cladosporium*, became generally prevalent over the Protectorate. Windbreaks appeared to afford protection from this disease.

Citrus fruits (lemon and orange) showed again a disease determined in 1915 as a form of *Colletotrichum gloeosporioides*. A *Nectria* appeared to have caused the death of a small patch of lemons at Njoro. A disease bearing a resemblance to the canker of South Africa is reported, but the trouble does not spread and apparently causes no loss. Foot rot or mal-di-goma was studied in 1918. This disease is always preceded by a heavy crop. The only remedy is to bare the roots to sun and air and to cut out the diseased wood and cortex. *Fusarium limonis* is always associated with the disease, though its causative agency has not yet been established.

Wheat rust appeared in a few places. Some very excellent wheat as regards rust resistance and yield was grown around Njoro.

A flax stem disease (*Macrosporium* sp.) is recorded from the experimental farm at Kabete.

[**Plant diseases, Africa**], C. R. ROSS (*Union So. Africa, Forest Dept. Ann. Rpt., 1918-19, p. 11*).—*Diplodia pinea* caused loss to owners of pine (*Pinus* spp.) in different localities named. *Pestalozzia hartigii* attacked transplants of *Pinus insignis* in nurseries. *P. funerea* was detected on transplants of *Cupressus arizonica*. *Phoma* sp. was reported on *Pinus teocote* and *P. leiophylla*.

Experimental work and fruit tree diseases [in Tasmania], J. M. WARD (*Tasmania Agr. and Stock Dept. Rpt. 1920-21, pp. 15, 16*).—Among the sources of loss here indicated, powdery mildew (*Podosphaera leucotricha*) has caused much loss, being present in nearly every orchard in Tasmania. Spraying for black spot was inconclusive, owing to climatic conditions which reduced injury on the unsprayed areas.

Club root [crucifers and hops], H. M. NICHOLS (*Tasmania Agr. and Stock Dept. Rpt. 1920-21, p. 12, fig. 1*).—Cruciferous club root (*Plasmodiophora brassi-*

cae) appears to be on the increase in Tasmania, though this disease has not done much harm in Australia. It develops only in acid soils, being encouraged by the use of acid chemical manures and is not difficult to control by liming.

Hop club root (*P. humuli*) causes loss in some parts of the island, being spread by irrigation water. It is thought that this organism also could be controlled easily by the use of lime.

Crown gall, E. M. DOIDGE (*Union So. Africa Dept. Agr. Jour.*, 3 (1921), No. 1, pp. 64-67, figs. 3).—A brief statement regarding the progress of crown gall (*Bacterium tumefaciens*) in South Africa since its appearance in 1910 includes a list which, though incomplete, names more than 25 local hosts of the organism. Lesions may take (in case of apple) the hairy root form, but usually retain the ordinary crown gall form.

Control measures outlined include deep planting for protection against frost injury, avoidance of mechanical injuries, and protection of the graft unions.

Infection studies with *Cystopus candidus*, PAPE and RABBAS (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18* (1920), pp. 58, 59).—Results of tests for susceptibility made on a number of plants, largely crucifers, are briefly noted.

A study of *Peronospora*, LAUBERT (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18* (1920), p. 63).—Persistence of viability could not be demonstrated regarding *Peronospora* in seed of *Erophila* and of *Spergula* that had been kept in paper bags for three years.

Studies on the lowering of resistance [to disease] due to loss of foliage, PAPE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18* (1920), pp. 53-58, figs. 3).—No lowering of resistance due to loss of leaves was demonstrated in case of *Vicia faba* subjected to attack by *Fusarium tubercularioides*.

Tests of protectives against plant diseases, RIEHM (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18* (1920), pp. 19-30).—An account of studies and results thereof are presented in textual and tabular detail regarding germination conditions of the spores of *Tilletia tritici*, tests of some new seed treatments for stinking smut, and the employment of fluorin compounds as fungicides.

[Injury to cereals in Germany due to *Dilophospora graminis*], H. PAPE (*Deut. Landw. Presse*, 48 (1921), No. 78, p. 582, figs. 6).—An account is given of the occasional former and recent outbreaks (generally mild) in different sections of cereal disease due to *D. graminis* (also of the relation of this fungus to *Dilophia graminis*), and of the characteristic results of the infection, principally failure of the grain and distortion of the heads.

A serious wheat disease new in France, I. BEAUVERIE (*Sur une Grave Maladie du Blé Nouvelle pour la France. Clermont-Ferrand: [Author, 1920], pp. 11*).—A threatening disease of wheat is noted as having appeared at several points in France. The fungus appears to be identical with *Dilophia graminis*, noted previously by Mangin (*E. S. R.*, 37, p. 247) in a similar relation. Particulars are noted in regard to the agreement of the causal fungus with the genus *Dilophospora*.

Field tests of treatments for wheat stinking smut, PAPE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18* (1920), pp. 50-52).—Details are briefly given regarding seed disinfection tests with formaldehyde, furfural, ferrocyanids of sodium and potassium, and Uspulun.

Sterility of oats, C. ELLIOTT (*U. S. Dept. Agr. Bul. 1058* (1922), pp. 8, pls. 4).—In a previous publication (*E. S. R.*, 22, p. 453) attention was called by Manns to the fact that sterility of oats was more or less directly proportional to the extent of blade blight. The author has given an account of investigations carried on to determine the relationship of sterility of oats to halo blight (*E. S. R.*, 43, p. 545). There was found to be considerable sterility on

oat panicles without any apparent connection with halo blight and in fields where there were no bacterial lesions. The amount appeared to vary with different varieties of oats, and did not seem to be in proportion to susceptibility to halo blight.

The author found by spraying plants with sterile water or water suspensions of bacteria and covering them for two or three days that the amount of sterility could be greatly increased. This is believed to indicate that rains falling about the time the oat sheaths are ready to open may have the same effect, and that the condition of the oat flowers at the time of rain or spraying is a controlling factor in the amount of sterility.

Studies with [diseases of] beans, PAPE (*Mitt. Biol. Reichsanst. Land. u. Forstw.* No. 18 (1920), pp. 42-50).—These notes include accounts of Gloeosporium attack on bean varieties during 1917-1919, effects of spacing on disease, and tests of treatments for control of bean dry spot.

Observations on the wilt disease of cotton in the Central Provinces, S. I. AJREKAR and D. V. BAL (*Agr. Jour. India*, 16 (1921), No. 6, pp. 598-617, pls. 2).—Of the two causal agencies of cotton wilt in this section, one being the stem-boring insect, *Sphenoptera gossypii*, and the other a fungus, only the latter is dealt with in the present article.

Two strains of a species of Fusarium have been isolated from wilted cotton plants and other causal connections with the wilt disease established by inoculation experiments. The two strains differ only in the color of the sclerotium-like bodies, which is dark blue or bluish green in one and whitish or pale brown in the other. The behavior of these two strains was studied. The reputed immunity of the buri cotton was confirmed. Only negative results were obtained from tests for toxins in connection with cotton wilt.

Melon disease, J. DUFRENÓY (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 405-420, figs. 16).—Melon fusariose, the chief topic here included, is discussed in connection with the morphology of the fungus, its retention in the soil, its transmission (in different ways), its connection with nematode attack, modes of infection, histochemistry of the lesions, and control. A bibliography of about 75 titles is appended.

Improvement of potato and its resistance to disease, J. AUMIOT (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 288-293).—Describing the characters and breeding behavior of some potatoes produced in the course of work previously noted (*E. S. R.*, 42, p. 233), the author claims that crossing and hybridization by artificial fertilization is the best means to renew and improve potato breeds and to develop strains superior from all points of view to those now in culture. The acquisition of disease resistance is one of the most notable results yet obtained. A second method less rapid and sure is that employing bud mutations in wild tuberiferous *Solanums*.

Potato diseases in Oregon and their control, M. B. MCKAY (*Oregon Sta. Circ.* 24 (1922), pp. 53, figs. 38).—Brief popular descriptions are given of most of the potato diseases known to occur in the State, and a few others are described in order that growers may be warned of their seriousness. Keys are prepared for the identification of potato diseases, and under the descriptions of the different diseases suggestions are given for their control, so far as definite means are known.

Potato diseases in France, H. M. QUANJER and E. FOEX (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 267-280).—The first part of this report is largely a review by Quanjér of the potato culture situation in various countries and parts thereof. The second part is largely a discussion by Foex of outstanding facts noted in the course of a tour discussed in the first part by Quanjér.

Potato diseases, C. PERRET (*Min. Agr. [France]*, *Ann. Épiphyties*, 7 (1919) - 1920), pp. 304-314).—The present report (E. S. R., 44, p. 845) presents detailed studies on causes and forms of potato degeneration, information acquired during 1920, and the conclusions based thereon.

Leptonecrosis is not infectious but is inherited, decreasing tuber yield, as does also potato mosaic. Removal of potato stock to new regions gives a sharply increased yield, though the change does not cure mosaic, leaf roll, or fillosity.

Diseases [of potatoes] and their control, P. KNORR (*Arb. Forschungsinst. Kartoffelbau*, No. 4 (1920), pp. 68-73).—In this section of the report, a brief account is given of studies on the susceptibility of potato varieties to canker, the influence of sterilization of soil and seed on crop return, mosaic disease, tuber heart rot, worm injury, and scab susceptibility as related to soil acidity.

Potato blight (*Jour. Jamaica Agr. Soc.*, 25 (1921), No. 10, pp. 371, 372).—Potato blight is mentioned as one of the most destructive agencies locally in Jamaica.

Studies regarding control of potato canker, C. WERTH (*Mitt. Biol. Reichsanst. Land u. Forstw.* Nos. 17 (1919), pp. 8-13; 18 (1920), pp. 17-19).—Locality and variety studies carried on since 1915 are tabulated (as to data obtained) with discussion regarding resistance to potato canker.

Potato leaf roll, E. FOEX (*Min. Agr. [France]*, *Ann. Epiphyties*, 7 (1919-1920), pp. 281-287, pls. 2).—The rolling of the lower leaves of potato plants, though regarded as the most constant symptom of leaf-roll disease, is said to be only one of the minor characters of this trouble, regarding the purely morphological features of which the author agrees in the main with Artschwager (E. S. R., 40, p. 543) and with Quanjer (E. S. R., 29, p. 347). An account is given of the microchemistry of the general and specific changes shown by the fiber. Leptonecrosis as here described is regarded as a process of pectic degeneration not far removed in character from a gummosis observed in Acaëia.

Potato scab, H. W. WOLLENWEBER (*Arb. Forschungsinst. Kartoffelbau*, No. 2 (1920), pp. 102, pls. 3, figs. 11).—This is a systematic discussion of potato scabbing diseases and causes, including organisms involved and other causal or contributory agencies.

Potato seed treatment in Mitchell County, 1919, R. H. PORTER (*Iowa State Hort. Soc. Trans.*, 54 (1919), pp. 306, 307).—This is a brief report on work carried out under R. O. Cromwell. Hot formaldehyde treatment as here employed consists in soaking the tubers for about 2.5 minutes in a formaldehyde solution of 1 pint to 15 gal. of water at a temperature of 118 to 122° F. The method here described is adapted to farm conditions and equipment, and shortens considerably the time required to treat the seed potatoes. Under good conditions a fair degree of scab control was secured. However, seed selection and crop rotation are regarded as indispensable.

Methods of treating seed potatoes in Mitchell County, F. E. TRACY (*Iowa State Hort. Soc. Trans.*, 54 (1919), pp. 307-309).—Some details are given regarding the work done under Cromwell, as reported above by Porter. The method of heating by steam is considered by the author as preferable. Temperature must be maintained between 118 and 122° F. This treatment controls not only scab but other diseases, notably black scurf, perhaps even more effectively.

Gumming disease of sugar cane in Java, S. F. ASHBY (*Agr. News [Barbados]*, 20 (1921), No. 506, pp. 302, 303).—A very brief note regarding cane gumming (Cobb's disease) in Brazil (50 years ago), Australia, Mauritius, Fiji, Argentina (probably), and Porto Rico is followed by notes giving important details taken from the account by Wilbrink (E. S. R., 45, p. 146).

The disease may be due to a strain of *Bacterium vascularum*, but fails to show the gum-flow symptom which is characteristic in other regions and on account of which the name Gomzlekte was adopted. The seed piece and cutting tools are important spreading agents. Insects may also act as carriers. The infection does not harbor in the soil, nor does it spread therein. Under favorable conditions practical recovery may occur.

Bacteria in sugar cane products, M. B. CHURCH (*Sugar* [New York], 23 (1921), Nos. 8, pp. 413, 414; 9, pp. 491, 492).—This is an account of bacterial studies based on samples of sugar and molasses obtained in cane sugar factories regarding not only the bacteria present, but also the molds observed, the forms of which included many others besides those listed by the Kopeloffs (E. S. R., 41, p. 416).

Tobacco diseases, PETERS (*Mitt. Biol. Reichsanst. Land u. Forstw.* No. 18 (1920), pp. 61–63).—This brief review deals with diseases of tobacco due mainly to fungi, some of these bearing relations to other plants named.

Relation between gummosis and mosaic, J. VAN DIJK (*Meded. Delt. Proefsta. Medan*, 2, ser., No. 11 (1920), pp. 13–15).—It appears that a tobacco plant affected with gummosis is less apt to be attacked by mosaic than a mosaic plant is to be affected with gummosis.

An investigation of some tomato diseases, F. T. BROOKS and G. O. SEARLE (*Brit. Mycol. Soc. Trans.*, 7 (1921), pt. 3, pp. 173–197).—Various rots of tomato fruits and certain diseases of the stems of tomato plants have been investigated as they occur on imported or home-grown fruit, being caused by several different fungi concerning the identity of which much uncertainty has existed. One rot is caused by *Phoma destructiva*, the British and the American form of which are identical. Another is produced by a fungus hitherto passing in this country under the name *Mycosphaerella citrullina*, but certainly not identical with the American fungus of the same name. The British fungus, hitherto mistaken for the American fungus and causing tomato stem canker as well as a fruit rot, appears to be identical with *Diplodina lycopersici*, which name also replaces *P. lycopersici*. A pyrenidial fungus, found once causing a tomato rot, is associated with an *Alternaria* stage, and the name proposed for this fungus is *P. alternariaceum*. Various strains of *Gloeosporium* and *Colletotrichum* parasitic on tomatoes have been isolated. One of these is identical with the American species *C. phomoides* and it is thought probable that all of these forms should be placed in this group. The desirability is emphasized of undertaking cultural studies of fungi belonging to such genera as *Phoma*, *Diplodina*, and *Colletotrichum* as an aid in the diagnosis of species.

Simultaneous treatment for insect parasites and cryptogamic diseases of fruit trees by use of mixed sprays, A. PAILLOT (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919–1920), pp. 169–194, pls. 2).—The object of this work was to study comparatively sprays as regards efficiency and convenience, facility and cost of preparation and application, lines most conducive to effective employment, and general conditions favorable to their application. Various combined treatments are dealt with in some detail as applying to different fruit trees of economic importance.

Apple blotch and bitter rot and their control, J. W. ROBERTS (*Tenn. State Hort. Soc. [etc.], Proc.*, 16 (1921), pp. 38–45, figs. 2).—It is stated, as a result of experience and observation during some years over a considerable area, principally in Tennessee, Virginia, Georgia, Arkansas, and Missouri, that blotch and bitter rot are about as destructive to apples in Tennessee as in some of the neighboring States. As regards seasonal order, these diseases follow scab (an early spring disease), blotch developing in late spring or early summer, and bitter rot being typically a midsummer or hot weather disease.

Blotch is a serious disease from the Ohio Valley south and southwest, though in recent years it has been extending toward the north. Resistant varieties include Winesap, Jonathan, and York Imperial. Blotch is controlled by keeping the fruit coated with Bordeaux mixture from about three weeks after bloom fall until midsummer.

Bitter rot is even more a southern disease than blotch, being particularly destructive in southern Missouri, Arkansas, southern Illinois, and Georgia, where it often destroys a large part of the crop in a few days. Varieties named as resistant include Akin, Bismark, Winesap, and Arkansas Black, and fairly resistant varieties include York, Stayman, Delicious, Maiden Blush, Rome Beauty, and Mammoth Black Twig. In nearly all cases bitter rot can be controlled by keeping the fruit covered with Bordeaux mixture during the hot season. Exceptional cases require different treatments, which are indicated.

It is stated that a spray put on before rain, if given time to dry, is better than one put on after a rain. The fruit must be well covered by the spray. This requires fine nozzles, good pressure, and spraying from different directions. Trees left unpruned or with thick heads can not be properly sprayed. The spray gun, though a good orchard tool, requires to be used by skilled hands in order to avoid damage due to overspraying. Neither blotch nor bitter rot is controlled by dusting.

Spray early for apple scab, L. R. HESLER (*Tenn. State Hort. Soc. [etc.]*, *Proc.*, 16 (1921), pp. 35-38, fig. 1).—Lateness in spraying in 1920 is said to have caused heavy loss, amounting in at least one large commercial orchard to 40 per cent of the crop. A thorough pink bud spray is important both to assure a good set of fruit and to prevent leaf trouble. The applications usually made later for insects, blotch, and bitter rot are helpful in preventing summer scab infections.

Apricot diseases in the Rhone Valley, J. CHIFFLOT (*Min. Agr. [France]*, *Ann. Épiphyties*, 7 (1919-1920), pp. 315-322).—The Rhone Valley, though furnishing a large annual output of fruits, principally apricot, peach, and cherry, is somewhat backward in disease prevention. Discussion applies to a few causes of loss with apricot, as *Stromatinia (Monilia) laxa*, and a few fungicidal treatments. A bibliography of about 25 titles is appended.

Peach leaf curl, B. F. DANA (*Wash. State Col. Ext. Bul.* 81 (1922), pp. 3-7, figs. 3).—A description is given of the leaf curl of peach due to *Eoascus deformans*, with suggestions for its control. Bordeaux mixture, lime sulphur, or plain copper sulphate are said to be efficient if properly applied. Experiments showed that fall applications were as effective as spring ones, and as the pressure of work is not generally so great as in the spring, spraying in the late fall is recommended. If spraying is delayed until spring it should be done before the buds begin to swell.

Polyporus igniarius injurious to the vine in Tunis, E. KIEN (*Rev. Vitic.*, 52 (1920), No. 1347, pp. 289, 290; *abs. in Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 9, pp. 1059, 1060).—Death or partial wilting of grape vines at the pruning season, observed near Tunis in 1919 and 1920, appeared to be due to a fungus, *P. igniarius*, probably carried on the pruning knives.

A new Sclerotinia on mulberry, E. A. SIEGLER and A. E. JENKINS (*Science*, n. ser., 55 (1922), No. 1422, pp. 353, 354).—A technical description is given of *S. carunculoides* n. sp., which is said to be the cause of a disease of mulberry characterized by enlarged portions of the fruit. A preliminary report is given on this disease in order that plant pathologists may be on watch for it.

Inspection of plant diseases (*Jamaica Dept. Agr. Ann. Rpt., 1920, p. 14*).—The recent revival of the banana industry, the large amount of replanting that took place in 1920, and the weather during that year, together resulted in a decided increase of the Panama disease during the period covered by this report, emphasizing the necessity of constant watchfulness and care. Banana trash is now known to be one of the chief vehicles for the transmission of this disease. A tabular showing is made regarding the numbers of diseased plants, new infected districts, new cases, recurrences, and total cases by months, April, 1920, to March, 1921, inclusive.

Investigation on the blood disease of bananas in Celebes, E. GÄUMANN (*Dept. Landb., Nijp. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 50 (1921), pp. 47, pls. 7*).—An extraordinarily severe banana disease prevalent in Celebes, Dutch East Indies, for several years has been investigated.

The disease involves the leaf crown, showing (after a period characterized by discoloration of a young leaf or two) sudden yellowing of the whole leaf crown and discoloration of the fruit. Internally, the symptoms (changes) resemble those due to the so-called Javanese disease. The changes in the fruit are most specific, including a yellowing or browning of the central vascular bundles extending even to the fruit rind. The diseased cells contain numbers of bacteria similar to those found in the old rotted rhizomes and in the soil. These are to be discussed in a later paper.

Transmission occurs from mother plants to younger plants or by way of the air. The bacteria, if applied to the stigma during the period of fertilization, reach the fruits through the style canal, and cases of such propagation have been found under natural conditions. The carrying agent has not been identified.

All the bananas observed and partially tested, including over 100 varieties both native and imported, are more or less susceptible to the disease. Active control measures at present include the removal of diseased plants and the rational employment of fertilizers.

Root fungi on cacao; cacao renewal, K. LUDWIGS (*Tropenpflanzer, 23 (1920), No. 7-8, pp. 167-173, figs. 9*).—Brief discussion is given of cacao root disease fungi, including *Lepiota* sp. and *Hymenochaete noxia*, and of reconstructive measures, including the utilization of sprouts from the stumps of trees cut, on account of disease, above the collar.

Experimental production of bacterial tumors, J. DUFRENOY (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 18, pp. 874-876, figs. 3*).—It is stated that in the forest of Barèges young trees of *Picea excelsa* near trees affected with canker show cankers or banded tumors.

Trees one year old, inoculated in August, 1919, by wounding with a needle previously inserted into the cambium of a canker, showed at the wounded point primary tumors in 1920. Forms of development are described. A bacterium which was isolated and cultivated is briefly described.

Abnormal ligneous formations in bark of *Hevea brasiliensis*, F. VINCENS (*Compt. Rend. Acad. Sci. [Paris], 171 (1920), No. 18, pp. 871-873*).—Of the prevalent forms of abnormality or deformations observable in the bark of *H. brasiliensis*, the ordinary tapping injury, the bark nodules (in some instances connected with the normal wood), and the fibers ramifying and anastomosing in a complex manner as herein described, the author discusses only the third.

These formations exist independently of infection by *Phytophthora faberi*. A *Fusarium* and a bacterium have been found. The fibers, and the plates derived from them, form around the latex tubes having altered contents, and extend themselves at the expense of the neighboring vessels.

Parasitic attack on *Eucalyptus globulus*, A. M. BOTTOMLEY and K. A. CARLSON (*Union So. Africa Dept. Agr. Jour.*, 1 (1920), No. 9, pp. 852-858, figs. 2).—An account of the damage caused by *Stereum hirsutum* on *E. globulus* in Transvaal plantations is preceded by remarks regarding this organism attacking trees at different points. The chief conclusion drawn is that attack by *S. hirsutum* on living tissues of eucalypts is probably confined to the species *E. globulus*. Recommendations regarding control include destruction of infected trees and stems, and replacing *E. globulus* with an immune species naturally adapted to local conditions, specifically *E. rostrata*.

Employment of casein and lime-water as fixatives with Bordeaux mixture, L. DEGRULLY (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 16, pp. 372, 373).—Adequate adherence is secured by adding milk of lime and casein to alkaline (but not to acid) Bordeaux mixture.

The addition is made up by mixing very intimately 50 gm. casein and 100 gm. slaked lime (both of these dried and finely powdered), and adding slowly with constant stirring (to avoid lumping) sufficient water to make a liter of this solution. This is added to 100 liters of alkaline Bordeaux mixture.

V. Vermorel is quoted as recommending the addition of a liter of skim milk to 100 liters of milk of lime as constituting an excellent fixative.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Game as a national resource, T. S. PALMER (*U. S. Dept. Agr. Bul.* 1049 (1922), pp. 48, figs. 4).—In this bulletin the author summarizes the present information on some of the larger problems of game conservation for use by individuals and associations interested in the subject. It is prepared with a view to a more general gathering of data for use in making a survey of game resources.

Preliminary rat virus investigations (*North Dakota Sta. Bul.* 155 (1922), pp. 4).—In investigations of the so called rat viruses advertised during the last few years, samples were obtained by an assistant in the U. S. D. A. Biological Survey direct from manufacturers or their authorized agents. All these were tested long before the date of expiration indicated on the label. The rats upon which they were tested apparently represented a variety of breeds and ages, since they ranged in color from a light yellow to black and in age from one-quarter-grown to the larger full-grown adults. The rats had access to plenty of water during the experiments and were given generous quantities of the material, which they at all times ate freely and with a relish.

The results of the feeding, which are presented in tabulated form, led to the following conclusions: "(1) That Reefer's Rat-Viro, Alexander Rat Killer, Pasteur's Liquid Rat and Mouse Virus, and Azon are shown by cultural methods to contain microorganisms which could be grown on various media, (2) that not one of these so-called viruses showed any qualities whatever of contagium, (3) that none of these so-called viruses produced infection or any other apparent disease conditions in rats as shown by the data contained herein, and (4) these investigations do not indicate that these products possess in any degree the efficiency and death-dealing qualities for rats as advertised and claimed by the manufacturers."

A lamp for taxonomic work in entomology, W. J. PHILLIPS and F. W. POOS (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 504-506, fig. 1).—A diagram and description are presented.

A study of the distribution of hydrocyanic acid gas in greenhouse fumigation, W. H. W. KOMP (*New Jersey Stat. Bul.* 355 (1921), pp. 5-22, figs. 15).—

The variation in the amount of cyanid used in practice to produce an insect killing strength of HCN led to the investigations here reported, which, as pointed out, may be accounted for in a number of ways, including influence of temperature and moisture conditions, the influence of condensation of moisture, and the tightness of the greenhouse. Of these the last mentioned appears to be the most important. The operation of these three factors is such as to render the accurate gradation of dosage in greenhouses impossible and has led to the great differences in recommendations as to dosage.

In order to overcome this element of uncertainty a machine was constructed by which the exact concentration of HCN in any part of the greenhouse being fumigated could be accurately determined. Tests made for the purpose of finding an indicator to denote quantitatively the presence of the gas resulted in the adoption of silver nitrate, which gave a sharper reaction than the iodine test with the minute quantities of HCN that were absorbed in the test, and it was decided to use it as an indicator, titrating the HCN absorbed in a solution of sodium hydroxid.

The apparatus, which is described, consisted of a set of four 8-liter aspirator jars, which draw air from the greenhouse through a N/100 solution of NaOH in a test tube by means of a modified Folin-Denis absorption tube. The gas was drawn from various parts of the greenhouse to the absorption tubes through rubber tubing. The absorption of HCN in the aspirated air was complete, as shown by testing the air for HCN by passing it through silver nitrate solution after it had passed through the absorber. The practical operation of the apparatus is briefly described.

The general plan of all the tests was to take a cross section of the house under fumigation, so disposing the tubes from the apparatus that air was drawn from a point just beneath the peak of the roof midway of the length of the house, from a point about a foot above the middle bench of the house, and from two points, one on each side above the side benches.

Five greenhouses at the college farm were used in the fumigation, the three larger of which each contained 25,369 cu. ft. The tests were conducted in conjunction with fumigations for aphids in the large houses and in cooperation with another series of experiments on the burning effect upon garden vegetable plants. The commercial cyanid of sodium known as Cyanegg was used in all the fumigations, all of which were made after dark, at the rate of 1 oz. of sodium cyanid to 1 oz. of concentrated sulphuric acid to 3 oz. by measure of water. The results of the work are presented in 15 graphs, which show the distribution of the gas in relation to dosage, temperature, and humidity.

Experiments conducted for the purpose of determining the minimum dosage for plant lice show the minimum dose for *Macrosiphum rosae* to be from 0.00015 to 0.0002 gm. HCN per liter, depending upon the temperature. The effect of different dosages on plant lice is reported in tabular form.

Control of sucking insects by dusting. P. J. PARROTT (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 82-85).—This is a summary of investigations of the apple red bugs *Ligyda mendar* Reu. and *Heterocordylus malinus* Reu., the currant aphids, the cabbage aphids, and the potato aphids. It is concluded that the apple red bugs and certain aphids may be effectively controlled by thoroughly dusting with sulphur-lead arsenate or calcium hydrate containing nicotine sulphate.

"The outstanding advantage of dusting is speed of operation, which effects noticeable economies in time and labor. A serious drawback is the high cost of the preparation, due chiefly to the large amount of nicotine required to make effective mixtures. Notwithstanding the economy in time and labor, dusting on the basis of existing prices for materials and labor has generally been more expensive than spraying, except possibly in the treatment of cabbages."

Derris as a promising insecticide, R. W. WELLS, F. C. BISHOPP, and E. W. LAAKE (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 90-95).—The author has found derris powder to be satisfactory as a destroyer of Mallophaga on chickens and cattle, but apparently not quite so effective on the latter as sodium fluorid. "It is very effective against Anoplura on cattle and dogs, one treatment accomplishing the destruction of all stages. The results of its use against fleas on dogs and cats are probably most striking, very small amounts being sufficient to destroy all fleas present. It appears to be effective for lice and fleas when reduced with from one to ten parts of a carrier to one part of derris."

Cheaper arsenicals and their use, G. E. SANDERS and A. KILLSALL (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 71-75).—In this discussion the authors deal particularly with arsenate of lime and white arsenic.

A homemade mechanical poison bait mixer, B. G. THOMPSON (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 508, 509, fig. 1).—A description and illustration is given of a poison bait mixer that has proved very successful in Oregon.

Arizona wild cotton or Thurberia and its insect enemies in relation to the cotton industry of the Southwest, A. W. MORRILL (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 472-478).—A discussion of the Thurberia boll-weevil problem in Arizona.

Dusting v. spraying for the control of insect pests on the avocado, F. G. MOZNETTE (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 465-469).—Dusting with dry sulphur was found to be equally as effective in controlling red spiders on avocado trees and over as long a period of time as spraying with liquid lime sulphur solution. None of the combinations of sulphur used controlled leaf thrips or leafhoppers, but a 40 per cent solution of nicotin sulphate, alone or in combination with lime-sulphur solution, or dry dusting sulphur will destroy them. "Liquid lime sulphur solution when combined with nicotin sulphate 40 per cent solution proved to be the most satisfactory combination used in combating the red spiders, leaf thrips, and leafhoppers, and remained effective against the red spiders over as long a period as did the lime-sulphur solution applied alone."

Observations of insect enemies of Liberian coffee in Surinam, A. REIJNE (*Dept. Landb. Suriname Bul.* 37 (1919), pp. 18).—The notes here presented relate to the green scale, *Lecanium viride* Green (pp. 5-12), a destructive ant, *Dolichoderus bidens* (pp. 13-17), and the coffee thrips, *Heliiothrips haemorrhoidalis* Bouché (pp. 17, 18) in Dutch Guiana.

Control of two scale insects of the mango, G. F. MOZNETTE (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 469-472).—The control of the tessellated scale (*Eucalymnatus tessellatus* Sign.) and the mango shield scale (*Coccus acuminatus* Sign.), which are the two most injurious enemies of the mango in Florida, may be most satisfactorily accomplished by the use of paraffin oil emulsions. An application in December at a strength of 1 gal. of stock solution to 70 gal. of water, followed by another in March at a strength of 1 gal. of stock solution to 80 gal. of water, gave good results.

Insect enemies of medicinal plants in the Crimea, I. PARENTJEV (*Bul. Soc. Path. Exot.*, 14 (1921), No. 3, pp. 164-167, figs. 5).—Brief references are made to some of the more important enemies of *Atropa belladonna*, *Hyoscyamus niger*, *Papaver somniferum*, *Althea officinalis*, *A. rosca*, *Feniculum officinale*, *Melissa officinalis*, and *Adonis vernalis*. The account is based upon studies conducted at the Pomological Experiment Station of Salghir, near Simpheropol.

White-ant-proof wood for the Tropics, T. E. SNYDER (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 496-501).—A discussion of naturally resistant woods and of chemical treatments of forest products.

Sources of infestation of Thrips tabaci in Iowa, J. L. HORSEFALL (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 493-496, fig. 1).—The author reports upon studies conducted in the vicinity of Davenport, Iowa. An account is given of injury to a field of onions by thrips which had hibernated in a field of alfalfa from which they were driven by its being cut. It is pointed out that where thrips have an opportunity to produce an early generation on set onions they will infest the seed onions in far greater numbers than would be the case were there no set onions grown in the neighborhood. Wherever set onions are planted in the vicinity of seed they have proved a source of infestation for the later crop, and it is doubtful whether the larger returns realized from the early crop compensate for this damage. One serious outbreak of thrips in a field of set onions near Davenport was directly traceable to the fact that adjoining the sets the grower had six rows of perennial multiplier onions. They also spread from greenhouses, where the thrips had a chance to breed on cucumbers through the winter. Elimination of the sources of infestation is far easier and more economical than checking the pest after the outbreak begins.

The cacao thrips (Heliothrips rubrocinctus Girdl), A. REYNE (*Dept. Landb. Suriname Bul.* 44 (1921), pp. 214, pls. 20, figs. 6).—The author presents an extended report of studies of this important enemy of cacao in Surinam, including its occurrence, life history and habits, economic importance, and means of control. It is the cause of a great loss of the crop and also of trees, and since planters are unable to prevent the death of the trees, those that die are usually replaced by coffee trees, no new cacao fields being laid out. The work includes a bibliography of 46 titles and an English summary of 20 pages.

The false apple red bug (Lygidea mendax) in Pennsylvania, S. W. FROST (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 102-104, fig. 1).—This account of studies by the author includes a chart showing the length of the nymphal stage during five successive years.

Artificial production of tipburn, F. A. FENTON and I. L. RESSLER (*Science, n. ser.*, 55 (1922), No. 1411, p. 54).—Experiments conducted at the Iowa Experiment Station, in continuation of those previously noted (*E. S. R.*, 45, p. 152), are briefly referred to. Emulsions made by crushing a large number of adults of both sexes of *Empoasca mah* in water failed to produce the disease when placed upon the leaf and the tissue pricked with a fine needle. A similar emulsion made from crushed nymphs failed to produce injury in more than a few cases, in none of which was it pronounced. It was demonstrated that these insects contain some toxic substance by placing the residue left over from the insects after the emulsion had been poured off on the leaf petioles and then picking this in by means of a fine scalpel. In every case a lesion was produced, the tissue at these points first turning yellow and then brown, and later the cells collapsed leaving a rather large scar.

The experiments with Bordeaux mixture indicate that it does not prevent tipburn by its action on the leaf but rather by its action on the insect. While it is toxic to nymphs, it acts comparatively slowly, since tipburn was produced even when a leaf colonized with live nymphs was kept sprayed with this compound.

Leafhoppers injuring woodbine, G. W. BARBER (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 502, 503).—The author records injury to American woodbine in eastern Massachusetts by leafhoppers of the genus *Erythroneura*.

The boom nozzle system and the traction duster as factors in grape leaf-hopper control, D. M. DeLONG (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 87-90, pl. 1).—The boom arrangement of set nozzles for spraying one row at a time from both sides and above—the nozzles being set horizontally to the vine on vertical rods at either side of the tank—has given very satisfactory results. In dusting work an economic control was obtained by the dust on some plats.

The apple sucker (*Psyllia mali* Sch.), W. H. BRITTAIN (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 96-101).—This is a brief review of the present status of knowledge of this pest, the presence of which in America was first detected in Nova Scotia in 1919 (E. S. R., 43 p. 850).

The Argentine ant builds earthen protections for mealy bugs, E. O. ESSIG (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 506-508, fig. 1).—The author describes shelters for mealy bugs constructed by Argentine ants in the branches of citrus.

New genera and species of Aphididae from Italy, G. DEL GUERCIO (*Redia*, 14 (1921), No. 1-2, pp. 107-136, pl. 1).—Two genera, namely Anuriella and Eucarazzia, are erected, and nine species of aphids occurring in Italy are described as new.

Biological studies of *Aphis rumicis* L., J. DAVIDSON (*Roy. Dublin Soc., Sci. Proc., n. ser.*, 16 (1921), No. 25-29, pp. 304-322, figs. 4) —This paper deals with (1) the appearance of winged forms and (2) the appearance of sexual forms.

Some further experience with contact dusts, T. J. HEADLEE and W. RUDOLFS (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 75-81, fig. 1).—From the data here presented it is concluded (1) that proper dust carriers impregnated with a 2 per cent nicotine are as effective in the control of the pink and green aphids on potatoes as is nicotine delivered in a liquid form; (2) that nicotine delivered as a dust has the disadvantages of a much longer period of kill than that necessary for nicotine delivered as a liquid, rendering the work of the dust liable to serious interference by rainfall, and the cost is materially larger than control with nicotine delivered as a liquid; (3) that the advantages of nicotine delivered as a dust are primarily concerned with the increased speed in covering large acreages and the freedom from the necessity of a near-by water supply; (4) that there occurs in all carriers with which the authors have experimented a tremendous waste of nicotine; and (5) that the improvement of nicotine dust is to be sought in the more rapid evolution of the 2 per cent or less of nicotine, which is within the range of reasonable practice, or in the delivery of such nicotine as is evolved in close contact with the bodies of the lice, or in developing along both these lines.

The European corn borer and the sugar cane moth borer; a comparison, T. E. HOLLAWAY (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 481-485).—The author's comparison of these two pests has led him to conclude that should the European corn borer invade the Southern States it may be even more injurious than in the North.

Controlling the army worm in southeast Missouri, V. KING and G. W. BARBER (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 486-488, pl. 1).—Control measures for the army worm are briefly considered.

Observations on natural enemies of the fall cankerworm (*Alsophila pometaria* Peck) in forests of southern Alleghany Mountains in 1920, F. SHERMAN (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 478-481).—This is a brief account of observations of birds in their relation to the fall cankerworm, of its predacious and parasitic insect enemies, etc.

Factors determining local infestation of the grape berry moth, J. G. SANDERS and D. M. DeLONG (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 488-490, pls. 2).—The author concludes that the most effective way to control the grape berry moth is by burning over and clearing waste places and headlands. A trial of this method during 1920 by one grower gave excellent results where a spotted infestation had occurred the previous year.

Further observations on the effect of certain chemicals upon oviposition in the house fly (*Musca domestica* L.), S. E. CRUMB and S. C. LYON (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 461-465).—This is a report of observations made in continuation of those previously noted (E. S. R., 38, p. 563). Tests of the oviposition response of the house fly to 15 chemicals, reported in tabular form, show sodium carbonate, with a comparative attractiveness of 94.2 per cent, to be the most attractive and ammonium hydroxid, with a comparative attractiveness of 32.6 per cent, to be the least so.

A seed potato maggot (*Hylemyia trichodactyla* Ron.), O. A. JOHANNSEN (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 503, 504).—The author records the rearing in June, 1910, of the anthomyid fly *H. (Phorbia) trichodactyla* from maggots infesting seed potatoes from Aroostook County, Me.

The Mexican bean beetle (*Epilachna corrupta* Muls.), G. M. LIST (*Colorado Sta. Bul.* 271 (1921), pp. 58, figs. 17).—This is a detailed report of studies of the life history and habits of the Mexican bean beetle, the nature of its injury, its natural enemies, and preventive and control measures, including spraying experiments with contact and stomach insecticides.

In Colorado, where in the infested sections it is a very serious pest of the bean crop, the adults appear from hibernation during the middle and latter part of June. In the Fort Collins section it passes through one complete generation, and some seasons probably 25 per cent of the first-brood adults deposit second-brood eggs, second-brood larvae often being quite abundant. A few individuals pass through a second complete life cycle, emerging as beetles late in the fall. The mortality of the second generation is high, and its larvae as a rule do little damage. The period of maximum injury usually occurs during the latter part of July and during August, the larvae being responsible for a large percentage of it.

Under certain conditions hand picking of the hibernated adults and first-brood eggs may be used as a means of control, but spraying with arsenite of zinc or arsenate of lead is the most satisfactory means. The least amount of injury to beans, which are very susceptible to injury from arsenical sprays, has occurred from the use of arsenite of zinc. It is recommended that arsenite of zinc be used at the rate of 1 lb. of the powder to 40 or 50 gal. of water, or that arsenate of lead be applied at the rate of 1 lb. of the powder to 40 gal. of water. One, two, or three applications may be necessary, depending upon conditions, and it should be applied to the under surfaces of the leaves. Only beans of the dwarf or bunch type should be grown, while early planted beans of an early maturing variety are most easily protected and generally most successful in badly infested sections.

A list of 25 references to the literature is included.

The reaction of the Japanese beetle to arsenical spray deposits, W. MOORE (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 67-71).—Investigations have shown that Japanese beetles are not repelled from sprayed foliage by the color, physical condition, or taste of the arsenical. They do, however, appear to be repelled by the toxic symptoms resulting from eating some of it. "Large quantities of the arsenical evenly distributed over the foliage will result in a certain percentage of the beetles eating a killing dose before the toxic symptoms develop. A certain percentage, particularly of the males, die without having eaten of the sprayed foliage, probably due to spray material obtained in cleaning their bodies and mouth parts."

Outline and progress of work being conducted against the Japanese beetle, *Popillia japonica* Newm., C. H. HADLEY (*Jour. Econ. Ent.*, 15 (1922), No. 1, pp. 62-66).—This is a further report of progress of work with the Japanese beetle (E. S. R., 46, p. 661).

Winter care of bees in Wisconsin, H. F. WILSON (*Wisconsin Sta. Bul.* 338 (1922), pp. 26, figs. 7).—In discussing this subject it is pointed out that the winter care of bees in Wisconsin covers three distinct periods, (1) the fall period, extending from September 1 to November 20, in which the bees are preparing for winter, (2) the winter period, from November 20 to March 21, in which the bees are expected to remain in the hives without flight and should not be disturbed except under extreme conditions, and (3) the spring period, from March 20, or the time when the bees are set out, until about the middle of May, during which time occurs the rebuilding of the loss of colony strength caused by winter conditions. The subject is discussed under headings of amount and kind of stores, cellar v. outdoor wintering, outside packing for bees, the bee cellar, and putting the bees out in the spring.

It is pointed out that the winter loss of bees is the most serious problem among Wisconsin beekeepers, where it reaches from 15 to 20 per cent and sometimes as high as 30 per cent. It is stated that the place where bees are wintered makes little difference provided other conditions are suitable, and that the temperature of the bee cellar must be near 45 to 50° F. to give the best results. Too much ventilation in the cellar may cause serious losses among the bees in winter, and it is important that bees should be well protected and sheltered against prevailing winds in spring. The bees should be removed early, but given protection during April and May and given large amounts of stores and not less than two hive bodies for the spring brood rearing. Each colony should be provided with more stores than it is thought can be used during April and May, or from 75 to 100 lbs. of stores to build up on during the spring.

Beekeeping in the clover region, E. F. PHILLIPS and G. S. DEMUTH (*U. S. Dept. Agr., Farmers' Bul.* 1215 (1922), pp. 27, figs. 7).—This consists of a description of the practices that have proved most effective for beekeepers in the clover region.

Beekeeping in the buckwheat region, E. F. PHILLIPS and G. S. DEMUTH (*U. S. Dept. Agr., Farmers' Bul.* 1216 (1922), pp. 26, figs. 7).—This publication undertakes to outline the methods which will enable the beekeepers of the buckwheat region to utilize fully this important source of honey.

Beekeeping in the tulip-tree region, E. F. PHILLIPS and G. S. DEMUTH (*U. S. Dept. Agr., Farmers' Bul.* 1222 (1922), pp. 25, figs. 6).—The authors describe a system which has been used with success by beekeepers in the tulip-tree region. They outline practices which will enable the beekeepers of the region to take full advantage of the tulip-tree source, which is one of the most dependable early sources of nectar throughout a wide region.

***Apanteles melanoscelus*, an imported parasite of the gipsy moth, S. S. CROSSMAN** (*U. S. Dept. Agr. Bul.* 1028 (1922), pp. 25, pls. 5, fig. 1).—This is a report of studies of one of the parasites imported from abroad during the course of work against the gipsy and brown-tail moths. The first part (pp. 2-14) contains a description of the species and an account of its life history and habits. *A. melanoscelus* Ratz. is close to *A. solitarius* Ratz., but the differences are thought to be sufficiently well marked and sufficiently constant to justify holding the two forms distinct. The methods used in the biological work are briefly described.

It hibernates as a third-stage maggot within its tough sulphur-yellow cocoon, and, under field conditions, the adults emerge over a period of about three weeks. Emergence is at its height when the gipsy moth egg hatching is at its maximum, usually during the second week in May. As in the case of many parasitic Hymenoptera, they often reproduce parthenogenetically. The greatest number of eggs secured from a single female was 535, and a dissection of this

individual showed that her ovaries still contained about 150 mature eggs and about 200 eggs in different stages of development, indicating that under natural conditions a female is capable of ovipositing in the vicinity of 1,000 eggs. From 48 to 72 hours are required for the incubation of the egg. There are three larval stages, which, depending upon the temperature, vary for the first stage from 2 to 3 days in the spring generation and from 6 to 8 days in the summer generation, for the second stage from 2 to 3 days by the first-generation larva and from 5 to 7 days by the second generation, and the period spent by the third-stage maggot within its host varies from a few hours to 2 days with the spring generation and as long as 3 days with the summer generation. The pupal stage lasts from 5 to 9 days.

The seasonal history varies considerably with the season and the issuance of adults of *A. melanoscelus* from their hibernating cocoons, commencing about the time of maximum hatch of the gipsy-moth egg, usually near the middle of the second week in May. Under field conditions, females of *A. melanoscelus* do not begin to oviposit immediately, for the bulk of issuance of the spring generation parasite maggots is around June 12. The adults which develop from these maggots are found issuing from 7 to 11 days later. Cocoons of the second generation, or those in which the parasite is to pass the winter, begin to appear about July 4, but usually not in abundance until the second week in July.

The records show that healthy gipsy-moth larvae eat from two to three times as much as those which contain parasite larvae. The gipsy-moth larva from which a parasite larva has issued eats no more, although it may live a few hours or as long as 2 weeks, the average being 7 days. While in field-collected material in this country it has only been reared from the gipsy moth, it is recorded as a parasite of the satin moth (*Stilpnolia salicis* L.) in Europe. It is thought to have been responsible for the death of many tussock-moth larvae during an outbreak of this pest at Somerville, Mass., in August, 1920. In experimental work it was reared from several larvae, including the tent caterpillar, the forest tent-caterpillar, the white-marked tussock moth, the brown-tail moth, and *Oleae basiflora* Pack.

The second part of the report (pp. 14-25) deals with the introduction and establishment of this parasite in the United States, and a map is attached which shows the dispersions of the gipsy moth and *A. melanoscelus* in New England in 1920. It is now firmly established and is spreading rapidly from the colonies which have been liberated, and is increasing in spite of its being heavily parasitized by secondaries. The fact that it is able to complete its life cycle on several native insects adds considerably to its value as a permanent parasite, and makes its permanent establishment more certain than if the gipsy moth were its only host.

Langstroth on the hive and honey bee, rev. by C. P. DADANT (*Hamilton Ill.: Amer. Bee Jour.*, 1922, 21. ed., rev. and rewritten, pp. IX+438. pl. 1, figs. 223).—This edition of the work previously noted (*E. S. R.*, 41, p. 463) has been revised and rewritten by C. P. Dadant.

The effect of time of sowing upon the control of the wheat sheath worm (*Harmolita vaginicum* Doa.), T. H. PARKS (*Jour. Econ. Ent.*, 14 (1921), No. 6, pp. 490-492).—Observations from 1918 to 1921, here reported in detail in tabular form, show that a very good control is secured in northeastern Ohio by sowing the wheat before October 1. Late sowed wheat and spring wheat suffer the most, the latter being very severely damaged, although this damage did not show up until after the winter wheat was harvested.

Sawflies injurious to rose foliage, W. MIDDLETON (*U. S. Dept. Agr., Farmers' Bul.* 1252 (1922), pp. 14, figs. 7).—This is a popular account of three species

of rose slugs that are well distributed and quite injurious over the United States east of the Rocky Mountains. The species considered are (1) the bristly rose slug (*Cladius isomerus* Nor.), a native form closely resembling a European species with which it has long been confused; (2) the European rose slug (*Caliroa aethiops* Fab.), which occurs in both Europe and North America; and (3) the coiled roseworm (*Emphytus cinctipes* Nor.), which is chiefly remarkable for its habit of boring into the ends of pruned shoots to pass its resting stage and which is named for the curled or coiled position it assumes when feeding upon the leaves.

C. isomerus is by far the most frequently encountered rose defoliator, and a rose bush is seldom seen which does not show some traces of its work. It occurs east of the Mississippi River and north of a line drawn from St. Louis, Mo., to Richmond, Va. The entire life cycle from egg to adult occupies about 30 days, and in the vicinity of Washington, D. C., there are six of these 30-day life cycles each year.

C. aethiops, probably the next most common rose sawfly, is reported as injurious in States as far west as the Rocky Mountains. It feeds upon the upper surface of the leaf by a characteristic chafing method, eating only the soft tissues and leaving the veins and under tissues showing yellowish on the green leaflet. When full grown the larva enters the ground, where it constructs a cell, within which cavity the quiescent period is spent. This stage occupies most of the year, or through the summer, fall, and winter until the following spring. Its life cycle is approximately a year in length, and the species has only one generation annually.

E. cinctipes is not especially abundant in any section of the country, but it occasionally occurs in sufficient numbers to attract attention, either because it bores into the pruned ends of shoots or because it feeds upon the leaves. It occurs from Minnesota to Maine and as far south as northern Virginia. The larvae, which hatch from eggs laid in the upper surface of the leaflet, first skeletonize patches from the underside of the leaflet but soon begin devouring all of the leaf tissue, first eating holes through and then feeding on the entire leaflet exclusive of the largest veins. When full grown this larva searches for a piece of soft wood or similar material, and when pruned ends of rose shoots are available it will bore into the pith of these and construct a gallery and cell for its resting stage. In the southern range of the species there are two generations, one having a short life cycle of several days more than a month and the other occupying the remainder of the year.

Diagrams are given which show the life and seasonal histories of the three rose sawflies. It is pointed out that their control is easy through the use of arsenate of lead applied at the rate of 1 lb. of the powder to 50 gal. of water, and 40 per cent nicotine sulphate used at the rate of 1 part to 800 parts of water in which some fish oil has been dissolved is also effective.

FOODS—HUMAN NUTRITION.

The diet in the different grades of society in Denmark, P. HENBERG (*Jour. Hyg. [London], 20 (1921), No. 4, pp. 366-370*).—A brief survey is reported of the diet in different levels of society in Denmark as indicated by 1,000 household accounts published by the State statistical department in 1897, 1909, and 1916. The data are presented in tables showing (1) the content per man value (American standards) per day of protein, fat, and carbohydrate, and the calculated energy value; (2) the percentage of calories in these diets contributed

by protein, fat, and carbohydrate; and (3) a general survey of the families investigated with reference particularly to the expenditure for food expressed as percentage of the total expenditure. The material dealt with included data obtained from laboring classes and "citizen" families in Copenhagen, in provincial towns, and in country districts, in all 17 classes being represented in the comparison.

The amount of protein per man per day varied from 84 to 118 gm., the fat from 75 to 121, and the carbohydrate from 364 to 522 gm. The percentage of calories contributed by proteins ranged from 11 to 14 per cent, fat from 26 to 35, and carbohydrates from 54 to 66 per cent. The highest proportion of protein was in the Copenhagen diets. The amount expended for food ranged from 25 to 64 per cent of the total expense, varying inversely with the income of the family.

References to Danish and German literature in which are given the detailed physiological reports of the diet of the various classes of families are appended.

The country hotel dining room, E. A. BOSS (*Hotel Mo.*, 30 (1922), No. 346, pp. 40-42).—Overhead charges and distribution of expenses are discussed in detail with reference to the operation of a small hotel dining room on the European plan.

The business of wholesale housekeeping (*Hotel Mo.*, 30 (1922), No. 347, pp. 37, figs. 3).—The subject is discussed on the basis of home economics work at Iowa State Agricultural College.

An improved method of caging and feeding mice, H. S. MITCHELL (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 5, pp. 299, 300, figs. 2).—A convenient form of individual mouse cage, which is said to facilitate handling and to make possible an accurate determination of food intake, is described and illustrated.

Some nutritive properties of nuts.—II, The pecan nut as a source of adequate protein, F. A. CAJORI (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 389-397, figs. 2).—In an attempt to explain the failure of rats to grow at a normal rate on diets in which the pecan nut served as the sole source of protein, as noted in the first paper of the series (*E. S. R.*, 44, p. 461), the proteins of the pecan nut were studied by methods developed by Johns and his coworkers (*E. S. R.*, 45, p. 9).

The principal protein of the pecan meat proved to be a globulin containing 15.76 per cent of nitrogen and 0.83 per cent of sulphur calculated on a moisture- and ash-free basis. The distribution of the nitrogen in this globulin, as determined by the Van Slyke method, was as follows: Amid N 9.8 per cent, humin N 3.6, arginin N 22.9, histidin N 3.7, cystin N 0.8, lysin N 6.2, monamino N 51.7, and nonamino N 0.8 per cent.

These figures would indicate that the protein of the pecan is of high biological value, and that the failure of rats to grow when the pecan nut furnishes the protein of their ration can not be due to an amino acid deficiency in the diet. Working on the hypothesis that the tannin present in the outer skin of the nut may render the nuts unsuitable for rats, nuts from which the outside skin was removed as much as possible were used in place of the whole nuts. Animals on this diet grew at a normal rate, thus showing that the presence of tannins is the limiting factor for the growth of rats.

Report of the committee on nutritional problems (dried milks), H. C. SHERMAN ET AL. (*Amer. Jour. Pub. Health*, 12 (1922), No. 2, pp. 113-116).—This annual report of the committee on nutritional problems of the American Public Health Association deals exclusively with dried milk with special reference to the possible development of the dry milk industry as a means of increasing, conserving, and marketing the milk supply. The report discusses in turn the

sanitary aspects of the milk drying industry, the nutritive value of dried milk and its products, and the possible effects of a dry milk industry upon the dairy industry and milk supply as a whole. It is shown that ordinary processes of commercial drying are more efficient than pasteurization in destroying the bacteria originally present in the milk, and that the dried product is no more subject to secondary contamination than any other dried food. In regard to its nutritive value, dried milk is considered to be equal in value to pasteurized milk, the only significant change occurring in either manipulation, if properly conducted, being in the loss of the antiscorbutic vitamin.

In regard to the effects of the dry milk industry upon the dairy industry, it is stated that "the opinion is widely held, and in our judgment well founded, that the dry milk industry will not seriously compete with or in any way injure the fluid milk industry as it now exists, but rather, will supplement it and make possible the good use of its seasonal surplus; that with increasing recognition by consumers of the great importance of milk as food for adults as well as for children, dried milk will come to be largely used in cookery without diminishing the consumption of milk in fluid form; that the drying of milk both as a means of preservation and of greatly reducing transportation costs will permit the extension of the milk industry into regions too distant from large markets to ship milk in fluid form; that because of this extension of the source of supply, the greater consumption of milk in its different forms should not necessarily result in higher prices; that the drying of milk will greatly facilitate the production and handling of milk in the South, where lack of natural ice so greatly hampers the fluid milk industry and where an increased use of milk in the diet is so urgently needed, and will doubtless do more than anything else toward the lowering of the infant death rate and the suppression of pellagra among adults"

A study of the combined action of raw cow's milk and orange juice as antiscorbutic substances, S. WRIGHT (*Biochem. Jour.*, 15 (1921), No. 6, pp. 695-702, figs. 2).—To determine whether orange juice and raw milk are capable of replacing each other in direct proportion to their respective antiscorbutic values, a series of experiments with guinea pigs was conducted in which, after a standardization of the antiscorbutic value of the orange juice used in the experiments, varying combinations of milk and orange juice were fed as the sole source of vitamin C with a basal ration of oats and bran, one animal being used for each combination.

Of the animals fed the basal diet plus 35 cc. of autoclaved milk plus orange juice, only those receiving 0.5 and 1 cc. of orange juice daily developed scurvy, thus establishing 1.5 cc. of orange juice as a minimum protective dose, a result in agreement with those of Davey (*E. S. R.*, 45, p. 869). The addition of 35 cc. of raw milk and 0.5 cc. of orange juice to the basal ration proved sufficient to prevent the onset of scurvy. A further series of studies is reported in which varying amounts of raw milk were given in addition to the basal diet plus 0.5 cc. of orange juice. When less than 40 cc. of milk was used sufficient autoclaved milk was added to bring the total up to that amount. Of two animals receiving 15 cc. of raw milk and two receiving 25 cc., one from each set developed scurvy and one did not. One animal receiving 35 cc. of fresh milk showed doubtful signs of scurvy, while one on this amount and one on 40 cc. did not develop scurvy.

In interpreting these results, the author is inclined to the opinion that a combination of the two antiscorbutics may be somewhat more potent than proportional amounts administered separately, but that, considering the possible variation in the antiscorbutic value of different samples of cow's milk,

the difference between the combined and separate actions of milk and orange juice is not marked.

The lymphoid tissues of the scorbutic guinea pigs showed no changes analogous to those reported by Cramer et al. to occur when vitamin B is withheld from the diet (E. S. R., 46, p. 867).

The antiscorbutic value of dehydrated fruits, P. E. ECKMAN (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 9, pp. 635, 636, figs. 2).—A brief report is given of a study of the antiscorbutic value of dehydrated peaches, apricots, apples, pears, prunes, cherries, and loganberries as determined by feeding experiments with guinea pigs on a basal ration of alfalfa meal and white flour in equal proportions, with 1 per cent of sodium chlorid. All the animals receiving from 0.5 to 2 gm. daily of the dried fruit died of scurvy within from 2 to 4 weeks. On increasing the amount of the fruit, peaches alone showed some value as an antiscorbutic. A daily ration of 4 gm., although insufficient to prevent scurvy, delayed its onset for 3 or 4 months.

The vitamins, C. FUNK, trans. by H. E. DUBIN (*Baltimore: Williams & Wilkins Co.*, 1922, pp. 502, figs. 73).—This is an English translation of the second German edition of this volume (E. S. R., 32, p. 578), which has been almost entirely rewritten. The subject matter is treated under the headings of the vitamin requirements of plants and animals; chemistry, physiology, and pharmacology of the vitamins; and the human avitaminoses—conditions in which the vitamins play a rôle. A list of 1,595 literature references is appended.

Vitamin content of rice by the yeast method.—Organic nitrogen as a possible factor in stimulation of yeast, W. D. FLEMING (*Jour. Biol. Chem.*, 49 (1921), No. 1, pp. 119-122).—In the course of unsuccessful attempts at the quantitative estimation of vitamin B content of rice by the yeast method, it occurred to the author that the addition of nitrogen in organic form to the inorganic nitrogen of the culture medium is one factor in the stimulation of yeast growth. In investigating this point the total nitrogen of several of the rice extracts used in the vitamin studies which had given unsatisfactory results was determined, and the ratio of organic nitrogen to inorganic nitrogen in the culture flask calculated. The data obtained are thought to confirm the suggestion that the yeast growth was stimulated by the varying amounts of organic nitrogen in the rice extracts.

Some oxidation mechanisms of the cell; the chemical dynamics of muscle, F. G. HOPKINS (*Bul. Johns Hopkins Hosp.*, 32 (1921), Nos. 368, pp. 321-328; 369, pp. 359-367).—These lectures, delivered at the Johns Hopkins University on April 12 and 13, 1921, deal principally with subject matter which has been previously noted from another source (E. S. R., 46, p. 110).

Excess protein and mammary secretion, G. A. HARTWELL (*Biochem. Jour.*, 15 (1921), No. 5, pp. 563-574, figs. 4).—This is the detailed report, with experimental data, of an investigation which has been previously noted from a preliminary report (E. S. R., 46, p. 65).

The metabolism of carbohydrates.—II, On the possible occurrence of stereochemical changes in equilibrated solutions of reducing sugars introduced into the circulation, J. A. HEWITT and D. H. DE SOUZA (*Biochem. Jour.*, 15 (1921), No. 6, pp. 667-671).—The investigation previously noted (E. S. R., 44, p. 259) has been extended to observations on the stereochemical condition of *d*-glucose, *d*-fructose, and *d*-galactose as soon as possible after removal from the circulating blood of anesthetized but otherwise normal animals. The general technique consisted in the intravenous injection into rabbits or dogs of the carbohydrate in question, the collection of the urine secreted in the following 5 minutes, and its examination for optical behavior, etc. Diuresis was first

induced by the injection of urea, sodium chlorid, or sodium sulphate, and a control sample of urine obtained, following which a 10 per cent solution of the sugar to be tested was injected, and a second sample of the urine collected within 5 minutes.

A comparison of the two samples of urine showed that these carbohydrates on intravenous injection undergo no stereochemical changes and that the equilibrium is unaltered in the urine excreted.

The basal metabolism of underweight children, K. BLUNT, A. NELSON, and H. C. OLESON (*Jour. Biol. Chem.*, 49 (1921), No. 1, pp. 247-262).—This paper reports the results of basal metabolism determinations made on two groups of children, most of whom were underweight. The first group consisted of 14 children attending a health school for underweight children held during the summer of 1920 in the home economics department of the University of Chicago, and the second group of 14 was from the university elementary school. Of the first group 13 of the children were from 10 to 20 per cent underweight, according to the standard used, and one, counted as normal, was 4 per cent underweight. The second group was composed of 10 underweight, 2 overweight, and 2 approximately normal-weight children. The ages of the children ranged from 9 to 12 years. The determinations were made with the Benedict portable respiration apparatus, using the general procedure described by Blunt and Dye (*E. S. R.*, 46, p. 166). The observations of oxygen consumption were made usually for at least two 10-minute periods with a few minutes of rest between. The results were calculated in the usual way as total calories per 24 hours, calories per kilogram of body weight, and calories per square meter of body surface.

The data obtained showed that the basal metabolism of underweight children tends to be higher than that of normal children. The average percentage excesses for the underweight children in the health school compared with the figures of Benedict and Talbot for children of the same weight were 22 for the total calories, 25 for the calories per kilogram, and 24 for the calories per square meter. In the elementary school the corresponding excesses were 14, 16, and 18 per cent. No close relation was observed between the percentage underweight and the excess metabolism.

Animal calorimetry, XVIII-XX (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 453-486, figs. 2).—In continuation of the studies on animal calorimetry, some of which have been previously noted (*E. S. R.*, 42, p. 259), three papers are presented.

XVIII. The behavior of various intermediary metabolites upon the heat production, G. Lusk (pp. 453-478).—In this paper the question as to whether acid radicles are the cause of the so-called specific dynamic action of foodstuffs was investigated by determining the effect on metabolism of the ingestion of acetic, glycollic, lactic, and hydrochloric acids, and of some of these substances in the form of their sodium salts. The materials were administered in a broth containing 2.5 gm. of Liebig's meat extract in 300 or 400 cc. of water. The materials used and the increase in metabolism per hour above the basal were as follows: Liebig's extract alone or with 8 gm. of NaHCO_3 0.5 calories per hour, 3 gm. acetic acid 3.1, 4.8 gm. lactic acid 2.7, the same amount of lactic acid in the form of its sodium salt 1.4, 7.6 gm. glycollic acid 1.5, a corresponding amount of sodium glycolate 0.88, 1.8 gm. hydrochloric acid 1.6, 9.55 gm. of glycine neutralized with sodium bicarbonate 5.3, 58 gm. of glucose 4.7, 50 gm. of glucose plus 8 gm. of lactic acid 4.6, and 50 gm. of glucose plus 3 gm. of acetic acid 7.23 calories per hour. It is pointed out that these results show that there is no relation between the number of potential hydrogen ions administered and the height of the metabolism.

The figures obtained with glucose alone and in combination are considered of significance. The practically identical increases over the basal metabolism caused by glucose alone and by glucose with lactic acid are thought to indicate that lactic acid behaves as an intermediary metabolism product of glucose. The figures for glucose and acetic acid, on the other hand, show a summation of the influence of the two factors involved identical with those obtained for carbohydrate and fat, and indicate that acetic acid behaves as an intermediary metabolism product of fats.

XIX. *The influence of acids upon the carbon dioxide-combining power of the blood plasma*, S. A. Taistra (pp. 479-483).—This paper deals with the reduction in the quantity of NaHCO_3 in the blood of a dog after the administration of acid substances in amounts which are comparable with the amounts given to the same animal in the experiments described in the above paper. The change in the CO_2 -combining power of the blood was determined with the Van Slyke apparatus (E. S. R., 37, p. 804).

The materials which caused the greatest increase in metabolism, glucose 50 gm. and acetic acid 3 gm., had no effect whatever on the CO_2 -combining power of the blood, while glycollic, lactic, and hydrochloric acids, which had comparatively little effect upon the heat production, caused a marked lowering of the CO_2 -combining power. The author concludes that "the specific dynamic action of the foodstuffs is not dependent upon the level of the alkaline reserve of the blood plasma as measured by its CO_2 -combining power."

XX. *The influence of the ingestion of meat and of glycine and alanine upon the carbon dioxide-combining power of blood plasma*, A. Chanutin (pp. 485, 486).—The ingestion of meat, of glycine, or of alanine resulted in all cases in an increase in the CO_2 -combining power of the blood plasma. "Since the administration of bicarbonate of sodium has no influence upon the heat production of a dog, it is evident that the great increase in the heat production which takes place during the hours immediately after the ingestion of meat is not determined by any change in the alkaline reserve of the blood, nor can such change be interpreted as being even a participating element in the causation of the phenomenon."

Day and night urine during complete rest, laboratory routine, light muscular work, and oxygen administration, J. A. CAMPBELL and T. A. WEBSTER (*Biochem. Jour.*, 15 (1921), No. 5, pp. 660-664).—The results are reported of the analysis of night and day urines of a single subject during three 5-day periods, (1) complete rest in bed, (2) 6½ hours ordinary laboratory routine, and (3) 1½ hours ordinary laboratory routine plus 5 hours' work (13,500 kg. per hour) on a bicycle ergometer.

Total nitrogen, creatinin, urea, uric acid, amino acids, water, and chlorids were excreted in greater amounts during the day, and ammonia, both in total and relative amounts, during the night. Sulphur in all forms was evenly distributed between day and night, thus showing a larger amount per hour per gram of nitrogen at night than during the day.

The acidity of the urine was distinctly higher at night than during the day. This is thought to be due to delayed excretion of certain fixed acids formed in the cells during the day. Phosphates were excreted under all routines in greater quantity during the night. This did not appear, however, to be connected with muscle or nerve metabolism, but rather with the increased acidity of the urine.

Calcium was excreted in greater amounts during the day than the night, while magnesium was evenly distributed.

Urochrome as a derivative of chlorophyll, H. E. ROAF (*Biochem. Jour.*, 15 (1921), No. 6, pp. 687, 688).—To determine whether urochrome is derived from

plant pigments, preliminary experiments were conducted on human subjects by testing the urine for urochrome after diets containing varying amounts of plant pigments. By restricting the amount of plant pigments, it was found possible to reduce the urochrome content of the urine by about one-fifth. Further experiments were carried on with guinea pigs with similar results. It was found that a diet deficient in plant pigments was associated with a urine deficient in urochrome, and that the green parts of plants (carrot tops) caused a marked increase in the color of the urine, while yellow pigments (carrots) caused no appreciable effect.

The author is of the opinion that urochrome is a derivative of chlorophyll, and in this connection suggests that the results obtained by Pelkan (E. S. R., 44, p. 169), who concluded that urochrome is related to the protein of the diet, may be due to plant derivatives associated with the proteins used.

Amino acid deficiency probably the primary etiological factor in pellagra, J. GOLDBERGER and W. F. TANNER (*Pub. Health Rpts. [U. S.], 37 (1922), No. 9, pp. 462-486*).—This paper gives a brief review of evidence in support of the theory that diet is the controlling factor in the prevention and causation of pellagra and the details of observations made during the course of studies at the Georgia State Sanitarium of preventive dietary measures.

The institution diet consisted chiefly of the cereals maize, wheat, and rice, some dried legumes, and beef. This was supplemented in the case of a group of colored and one of white patients with inorganic salt mixtures, each daily dose of which contained the equivalent inorganic elements of a liter of whole milk. In addition, two drops daily of sirup of iron iodid were given to make sure of a liberal supply of iodine and to increase somewhat the low content of iron in the salts. In spite of the improvement in the diet thus brought about, a number of cases of pellagra occurred, five of which are described.

Further to improve the diet, a daily supply of 3 oz. of fresh tomato juice and $\frac{1}{2}$ oz. of cod liver oil was added to the previous diet, and a regular ration of at least $\frac{1}{2}$ oz. of cowpeas was substituted for the variable and irregular supply of legumes, these changes being made to furnish a more abundant vitamin supply. Three cases of pellagra developed among the individuals known to have taken the full ration.

In discussing these observations, the authors conclude by a process of elimination that the protein factor alone was concerned in the development of pellagra in the cases cited. They further state that while their conclusions are in substantial agreement with those of Wilson (E. S. R., 46, p. 762), they are of the opinion that a low biological protein value in the sense used by Wilson is not necessarily indicative of a pellagra-producing diet, but that the deficiency is probably some special combination or, within narrow limits, special combinations of amino acids. "In this connection it should be pointed out that the possibility that some as yet unknown dietary essential, either alone or in combination with the protein factor, plays the dominating rôle in this disease, while perhaps very remote, is not excluded and should, therefore, not be wholly disregarded."

To test this theory still further, a few therapeutic experiments with certain amino acids have been made from which as yet no definite conclusions can be drawn. It is noted, however, that in two cases the skin lesions showed a markedly favorable response to cystin, and in a third slight improvement occurred following the administration of a daily dose of 1 gm. of cystin and 2 gm. of tryptophan during a period of 31 days in which the diet remained unaltered.

Studies on experimental rickets.—IX, Lesions in the bones of rats suffering from uncomplicated beriberi, P. G. SHIPLEY, E. V. MCCOLLUM, and

N. SIMMONDS (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 399-410, pls. 4, figs. 4).—The authors report in this continuation of the studies on experimental rickets (E. S. R., 46, p. 473) that the bones of rats on diets deficient only in vitamin B resemble in practically all histological details the bones of guinea pigs suffering from uncomplicated scurvy. It is suggested that the condition of the bone marrow may be analogous to the condition of the intestine, as described by McCarrison (E. S. R., 42, p. 463).

The cure of infantile rickets by sunlight as demonstrated by a chemical alteration of the blood, A. F. HESS and P. GUTMAN (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 31-34).—This report presents chemical data which substantiate the clinical and anatomical evidence previously reported (E. S. R., 46, p. 165) of the curative action of sunlight on rickets. Following the statement of Howland and Kramer (E. S. R., 46, p. 165) that the inorganic phosphorus of the blood serum of infants is low in active rickets and tends to increase during the process of healing, phosphorus determinations by the colorimetric method of Bell and Dolsy (E. S. R., 44, p. 613) were made of the blood serum of 9 infants during the course of sun treatment for rickets.

The values obtained for inorganic phosphorus confirm the conclusions of Howland and Kramer, rising gradually from the low level of less than 3 mg. per 100 cc. to the normal of about 4 mg.

"It is evident that sunlight not only brings about a cure of the rachitic lesions, but in so doing occasions chemical changes in the blood similar to those noted when the cure is effected by cod liver oil. This is of interest as affording testimony that the curative process occasioned by these divergent therapeutic agents is fundamentally the same. These observations establish a chemical basis for heliotherapy in rickets. They furnish also, as far as we know, the first definite evidence of metabolic change in the animal body brought about by the solar rays."

The cure of infantile rickets by sunlight, accompanied by an increase in the inorganic phosphate of the blood, A. F. HESS and M. G. GUTMAN (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 1, pp. 29-31).—Essentially noted above.

The prevention and cure of rickets by sunlight, A. F. HESS (*Amer. Jour. Pub. Health*, 12 (1922), No. 2, pp. 104-107).—A general description of investigations which have been noted in detail from other sources.

Experimental rickets.—III, **The prevention of rickets in rats by exposure to sunlight**, A. F. HESS, I. J. UNGER, and A. W. PAPPENHEIMER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 8-12; also in *Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 77-82, pls. 2).—In continuation of the studies previously noted (E. S. R., 46, p. 165), a brief report is given of an investigation of the value of sunlight in the prevention of rickets in rats. Rats on the experimental diet No. 84, found by Sherman and Pappenheimer invariably to produce rickets (E. S. R., 45, p. 767), were kept in absolute darkness, one series being taken out of the room and exposed to direct sunlight for a period of 15 to 30 minutes four or five times a week, and the remaining animals kept entirely in the dark. After three weeks the animals were X-rayed and after from 30 to 40 days were killed and autopsied.

The animals which were exposed to sunlight showed no signs of rickets, while all of those kept in the dark developed rickets.

To test the counterbalancing effect of phosphate and darkness, a series of tests was carried out with additions of small and increasing amounts of potassium phosphate to the standard dietary. Half of these rats were exposed to sunlight for 30 minutes daily. Of these none developed rachitic lesions, while in those which were kept in the dark active rickets developed

on the diet containing an addition of 25 mg. of phosphorus but not on a diet containing 75 mg. of phosphorus. This is thought to indicate that if the phosphate content of the diet is adequate rats do not develop rickets in spite of being kept in the dark, but that a short exposure to sunlight is equivalent to almost doubling the protective dose of phosphate.

The prevention of the development of rickets in rats by sunlight.—[**XI, Studies on experimental rickets**], P. G. SHIPLEY, F. A. PARK, G. F. POWERS, E. V. MCCOLLUM, and N. SIMMONDS (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 43-47).—Results similar to those reported above by Hess, Unger, and Pappenheimer have been obtained with rats on a diet containing nearly twice the optimum content of calcium and decidedly below the optimum of phosphorus and vitamin A. The technique differed from that of the above-noted study in that the control animals were kept in glass-screened rooms instead of dark rooms and the others were exposed for longer periods of time to the action of sunlight, the total period of exposure varying between 242 and 273 hours, representing an average daily exposure of 4 hours.

The sunlight, while completely preventing rickets, did not entirely compensate for the deficiency of phosphorus either as regards growth and development as a whole or growth of the skeleton. The authors conclude that "neither cod-liver oil nor light meets the defects in the composition of the diet directly by supplying to the body either calcium or phosphorus, but meets them indirectly by so raising the potential of cellular activity as to secure the most efficient utilization possible of those substances available in the body which are directly or indirectly concerned with ossification and calcification."

Botulism from the regulatory viewpoint, C. THOM (*Amer. Jour. Pub. Health*, 12 (1922), No. 1, pp. 49-53).—In this paper, which was read at the annual meeting of the American Public Health Association in New York City November 17, 1921, the author discussed the precautions that must be taken to prevent outbreaks of botulism, and the necessary action by health officials to limit the number of cases following the first evidence of an outbreak. The more significant characteristics of *Bacillus botulinus* and its toxin are discussed, with several references to the literature.

ANIMAL PRODUCTION.

Genetics and eugenics, W. E. CASTLE (*Cambridge: Harvard Univ. Press; London: Humphrey Milford*, 1921, 2. ed., rev., pp. VIII+395, pls. 51, figs. 32).—This is a second and revised edition of the book previously reported (E. S. R., 40, p. 274). Many changes have been made, especially in the subjects dealing with the nature of genetic changes, their frequency and location in the germ cells, blending inheritance, linkage, inbreeding, and heterosis. In the previous work the author has furnished evidence from hooded rats to show that unit characters are quite variable, whereas in the revised book proof is furnished by further crosses with hooded rats to indicate that unit characters are more constant.

The production of nondisjunction by X-rays, J. W. MAJOR (*Science, n. ser.*, 55 (1922), No. 1420, pp. 295-297).—An experiment in which exceptional sons of *Drosophila melanogaster* were produced by X-raying the mothers has been reported (E. S. R., 46, p. 673). The present article is a report of further investigations at Union College to determine whether exceptional daughters were also produced as a result of X-rays. For this test 17 white-eyed normal females were crossed with eosin-eyed miniature-winged males, and 1,743 eosin-eyed normal winged daughters and 1,726 white-eyed normal winged sons and 1

eosin-eyed miniature-winged son (exception) were produced. Thirteen full sisters of the above females were X-rayed soon after emerging from the pupa cases and were mated with eosin-eyed miniature-winged males, producing 512 daughters and 467 sons. Two exceptional daughters (white-eyed normal winged) and 12 exceptional sons (eosin-eyed miniature-winged) were produced by the only 9 of the 13 X-rayed females that had over 10 offspring each. This is shown to be a much larger percentage of exceptional offspring than would normally occur by nondisjunction.

According to Bridge's work on nondisjunction (E. S. R., 35. p. 272), exceptional males are of the chromosome formula XO, coming from eggs which are without an X-chromosome, fertilized by a sperm bearing an X-chromosome. Exceptional females are of the formula XXY, coming from an egg carrying two X-chromosomes fertilized by a Y-bearing sperm. Exceptional females crossed with males like their fathers should produce further exceptions.

Further tests on the exceptional individuals produced in this experiment showed that all the exceptional males tested were sterile, whereas one of the exceptional females was fertile and the other was sterile. The fertile exceptional female produced 5 exceptional sons and 1 exceptional daughter. This daughter in turn produced 1 exceptional daughter, whereas 2 of the exceptional sons proved sterile. It is the author's conclusion that X-rays affect the egg cells during maturation, and produce a condition which in the first generation seems identical with primary nondisjunction.

Identical twins in pigeons arise from ova of markedly aberrant size, O. RIDDLE (*Soc. Expt Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 12-14).—In weighing, incubating, and observing the embryos and young of from 15,000 to 20,000 pigeon eggs at Cold Spring Harbor, N. Y., seven instances of identical twins have been found, two of which were previously reported (E. S. R., 41, p. 867). Twin-bearing eggs were mostly the largest eggs laid by the birds during the entire year, though there were some exceptions. The three pairs of twins of which the sex was determined were all female. A table showing the weights of eggs laid previous to the twin eggs and the maximum and minimum weights of other than twin-bearing eggs is given.

The coefficient of corpulence, G. SPRITZ (*Arch. Escola Super. Agr. e Med. Vet. [Niteroy, Rio de Janeiro]*, 5 (1921), No. 1-2, pp. 41-57, pls. 3).—This is the presentation of formulas for use in judging and selecting animals so that a more definite mathematical standard may be set for the proper relation of the different parts of the animals. The author reviews similar formulas by Baron and Barrier and applies them to different types of French war horses. These formulas not seeming adequate for all purposes, the following formula is suggested for what is called the index of corpulence:

$$I = m \times \frac{C^2}{N}$$

In this formula I equals the index of corpulence, C the heart girth, N the height in centimeters above 1 meter, and *m* is a constant to be determined for the different classes of animals. In the case of war horses *m* was found to equal 10 when the index for an average horse would equal 1. The indices for light type, longer-bodied horses were then found to range below 1 and for the heavier draft horses above 1.

When this formula was applied to cattle, the respective classes of animals were fairly well defined, but the index was found to be much larger in all cases because of the height of cattle being proportionately less than that of horses of similar weight and size.

Characteristic effects upon growth, oestrus, and ovulation induced by the intraperitoneal administration of fresh anterior hypophyseal substance, H. M. EVANS and J. A. LONG (*Natl. Acad. Sci. Proc.*, 8 (1922), No. 3, pp. 38, 39).—An experiment is reported in which a characteristic acceleration of growth was produced in rats treated intraperitoneally with finely ground fresh anterior lobe of the hypophysis of beef. Full litter mates of these rats were used as controls.

In one case on the three hundred and thirty-third day a treated rat weighed 596 gm., whereas its litter mate control weighed 248 gm. This extra weight was due largely to fat, but there was some enlargement of practically all the organs except the uterus, which was smaller. The ovaries, however, weighed about twice as much as in the control lots, but oestrus seemed never or only very rarely to occur. A histological examination of the gonads showed the presence of very abundant amounts of lutein tissue.

Vitamins on the farm.—Their practical relation to live-stock feeding, A. R. LAMB and J. M. EYVARD (*Iowa Sta. Circ.* 73 (1922), pp. 8, figs. 4).—This is a popular discussion of vitamins with special reference to their application to animal feeding. The authors state that vitamin A is the one most likely to be lacking in animal feeds, and for that reason special precautions should be taken to have it present.

The value of feeding stuffs, II. NEUBAUER (*Landw. Ztschr. Rheinprov.*, 23 (1922), No. 7, pp. 70, 71).—This article deals with the present prices of feeding stuffs in Germany and takes up the energy value (starch equivalent) of the more important ones. Based on the prices at Cologne, the feeding stuffs mentioned are listed according to the cost of energy as follows, the most expensive sources of energy appearing first: Fish meal (fat free), linseed meal, clover hay, brewers' dried grains, meadow hay, peanut cake, wheat bran, oats, dried yeast, distillers' dried grains, field peas, barley, ground rape (oil removed), sesame cake, sliced beets, rape seed cake, oil palm nut, corn, rice feed meal, rye bran, coconut cake, dried beet pulp, molasses feed (50 per cent molasses), ground oil palm kernels (oil removed), peat molasses (30 per cent peat), and meat meal. A table is presented giving various combinations of these feeds which will furnish an equal amount of energy and thus facilitating the balancing of rations.

The composition and feeding value of wheat by-products, G. S. FRAPS (*Texas Sta. Bul.* 282 (1921), pp. 5-42).—This is the report of a study of the composition and feeding value of wheat by-products. The milling of wheat is described and the definitions of wheat by-products given as adopted by the Texas Feed Control Service (E. S. R., 45, p. 68). Standards for the composition of wheat by-products, as recommended to the Association of Feed Control Officials of the United States for adoption, are compared with the Texas standards. The average composition of wheat by-products and a number of digestion coefficients on wheat feeds, as reported in previous Texas and other station bulletins, are given in tabular form. The productive values and the feeding values of wheat products are given as calculated and as determined from experiments at the Texas, Ohio, Missouri, Nebraska, and Montana Experiment Stations. The use of wheat by-products are discussed, with special reference to the animals to which they are most adapted.

A study was made of the siftings from the various products to see if it were possible to check the names under which the feeds were sold and to prevent misbranding by this means. Great variation was found in the amount and composition of siftings from feeds of the same name, but a standard was suggested as follows:

Suggested sifting standards for wheat by-products.

Wheat by-product.	On 14-mesh sieve.	On 14 and 20 mesh sieve.	On 48-mesh sieve.	Through 48-mesh sieve.
	Not more than—		Not less than—	
	Per ct.	Per ct.	Per ct.	Per ct.
White shorts.....	1	5	.....	60
Gray shorts.....	3	10	40	20
Brown shorts.....	5	20	50	.....
Mixed feed.....	40	60	20	10

Of a large number of samples examined, the greater portion of them agreed with this sifting standard. Sifting tests considered with chemical analyses may be of great help in detecting adulteration or misbranding of wheat by-products. References are made in the bulletin to, and data are taken from, work previously reported (E S R., 18, p. 70; 23, p. 578; 31, p. 869; 32, p. 862; 34, pp. 467, 769; 35, p. 561; 36, p. 615; 38, p. 369; 40, p. 571; 42, p. 769; 45, p. 68).

Adulteration of wheat mill feeds, W. H. STROUD (*Hoard's Dairyman*, 63 (1922), No. 6, pp. 188, 221).—The standard for maximum fiber content for the following wheat feeds has been adopted by the Association of Feed Control Officials and the Wisconsin Department of Agriculture: From soft wheats, red and brown shorts 6.5 per cent, total or gray shorts 5.5, wheat middlings 3.5; from hard wheats, standard middlings 9.5, flour middlings 6, and red dog flour 4 per cent. A higher fiber content means that the feeds are adulterated.

The effect of sodium hydrate upon the digestibility of grain hulls, J. B. LANDSEY (*Science*, n. ser., 55 (1922), No. 1414, pp. 131, 132).—An experiment at the Massachusetts Experiment Station is reported in which the digestibility of oat hulls and rice hulls, untreated and treated with dilute sodium hydrate, was determined on two sheep. Treating increased the coefficient of digestibility of the dry matter for oat hulls from 36 to 81 per cent and for rice hulls from 5 to 29 per cent.

Rations for live stock, T. B. WOOD (*Mh. Agr. and Fisheries* [London], *Misc. Pub.* 32 (1921), pp. 40, figs. 6).—This publication deals with the general principles of animal feeding, as well as giving a brief description of the more common feeding stuffs with reference to the class of animals for which they are best adapted. Sample rations are also given for the various classes of animals. Tables and graphs are presented which should aid in balancing rations.

Cattle feeding investigations.—Comparative value of silage for making beef, W. L. BLIZZARD (*Oklahoma Sta. Bul.* 139 (1921), pp. 6).—In a cattle feeding experiment to study the value of various kinds of silage for beef production, five lots of grade Hereford calves were used in the test, which began December 29, 1920, and continued for 185 days. The cattle were all fed a basal ration of 1.03 lbs. cottonseed meal, 11.26 lbs. shelled corn, and 1.03 lbs. alfalfa hay per head, which was supplemented by 13.1 lbs. of silage, lot 1 receiving sunflower silage, lot 2 cane silage, lot 3 darso silage, lot 4 corn silage, and lot 5 kafir silage. At the conclusion of the test no difference was noted in the finishing of the cattle, as they were all sold to a packing house for the same price per hundred. The following table shows the results which were obtained in gains, feed consumed, etc., for the different lots:

Weights, gains, shrinkage during shipment, and dressing percentage on various silages for beef production.

Lot.	Kind of silage.	Average weight.		Average gain.		Shrinkage per head.	Dressing percentage.
		Initial.	Final.	Total.	Per day.		
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Per ct.
I.....	Sunflower.....	428	822.66	394.66	2.13	28.66	55.9
II.....	Cane.....	447	816	369	1.99	42	66.8
III.....	Darso.....	440.6	826	379.4	2.05	36	56.2
IV.....	Corn.....	438.2	823	384.8	2.08	39	56.2
V.....	Kafir.....	414	812	368	1.98	28	54

The sunflower silage in the combination fed produced the best gains, and the shrinkage of this lot during shipment was low. The calves seemed to have more capacity for the sunflower silage than for any of the other silages. The cattle receiving kafir silage showed a lack of appetite during the last 40 days and did not finish with as much bloom as the other four lots. The author states, however, that all these silages have considerable feeding value for beef production. References are made to the results of the 1919-20 feeding trials at the station (E. S. R., 45, p. 375).

Sheep feeding investigations.—Comparative rations for wintering breeding ewes, A. E. DARLOW (*Oklahoma Sta. Bul. 136 (1921), pp. 7*).—This is the report of an experiment to study the advantages of different Oklahoma grown feeds and rations for wintering ewes. Five uniform lots of 15 ewes each were selected for this test, which lasted from December 18 to March 18. All ewes not previously bred were turned with rams on November 10. The following table summarizes the rations fed and results obtained in the experiments:

Weights, gains, feed consumed, and cost of rations for wintering ewes.

Lot					Feed consumed per head per day							Average cost of feed per head per day.
	Initial weight.	Final weight.	Gain.	Gain per ewe	Weight of lambs born.	Alfalfa hay.	Darso silage.	Whole kafir.	Ground kafir.	Ground Darso.	Sunflower silage.	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Cents.
I.....	1,722	1,922	200	13.33	60	2.125	4.1	0.615	.....	.....	.....	4.41
II.....	1,722	2,042	1,320	21.33	30	2.02	3.4	.....	.....	.....	.....	4.3
III.....	1,722	1,992	1,270	18	90	2.02	2.43	.....	0.615	.....	.....	4.3
IV.....	1,714	1,894	180	12	50	2.06	2.43	.....	.....	0.615	.....	4.41
V.....	1,716	1,713	27	1.8	100	2.06	.....	.....	0.615	.....	3.43	4.41

¹ One ewe died in Lot II, weight 132 lbs., and one in Lot III, weight 161 lbs.

The weight of lambs born are not included in the above table with the weights of the ewes at the end of the test.

Lot 1 made satisfactory gains without grain but did not show the bloom or vitality of lot 2 which received whole kafir, nor were the lambs in lot 1 as strong as those in lot 2. By comparing lots 2 and 3 there seemed to be a little advantage in favor of the ground kafir when lambs are considered, but this is not thought sufficient to warrant the grinding of the grain. Lots 3 and 4 showed an advantage for ground kafir over ground darso both in the weight of the ewes and in the lambs. The sunflower silage did not give as good results as the darso silage. The sunflower silage was eaten well at first,

but the ewes soon tired of it and did not clean up their feed well toward the end of the test.

Sheep losses in Colorado feed lots, G. H. GLOVER and I. E. NEWSOM (*Colorado Sta. Bul.* 270 (1921), pp. 3-25).—This is a report of experiments carried on at the station during 1916-17 and 1917-18 to determine the cause of the losses of lambs during the feeding periods in that State. From an examination of losses which have been reported and studied, the cause of the losses seemed to point to too heavy feeding or possibly irregular feeding.

With this idea in view, 18 rather weak lambs averaging about 35 lbs. were selected in December, 1916, for experimental work. The lambs were all fed alfalfa hay supplemented with the following grain rations to different lambs in amounts varying from $\frac{1}{4}$ lb. per day to all they would eat: Barley chop, corn chop, peas and barley, peas and corn chop, and peas, corn, and barley chop. With the last three combinations radical changes were made in the rations at different times to see if losses or sickness of the lambs would result, i. e., in the case of peas and corn chop, peas were fed for a time and then a change was made to corn chop, then back to peas, and later back to corn chop. The feeding periods varied from 34 to 110 days.

Of the 6 lambs receiving barley chop, the 1 fed most carefully died and 3 others were sick. All 5 on the corn chop were sick at some time. Of the 2 on peas and barley neither was sick; of the 3 on peas and corn chop 2 were sick; and of the 2 on peas, corn chop, and barley 1 was sick. Those in the combination lots which sickened were eating corn at the time reported. In 9 of the 11 animals reported sick the illness followed an exceptionally large consumption of grain.

In the 1917-18 experiments, 2 lots of 10 strong lambs weighing about 50 lbs. each were selected. In lot 1, during a feeding period of 3 months, the grain was changed from corn to barley and back to corn, with periods of 4 and 11 days when no grain was given. Changing to barley the first time produced 1 sick lamb. Stopping barley for 4 days and then continuing it resulted in 3 sick lambs. Stopping barley for 11 days and continuing with corn produced no bad effects. The lambs in lot 2 were given ground barley from January 10 to 29, when the grain was stopped 4 days, then continued for 14 days, then stopped for 11 days, followed by corn chop for 7 days. No lambs were reported sick. In both lots the grain and alfalfa hay were fed ad libitum. During the 1917-18 experiments the lambs were on heavy grain rations, but were frequently changed or discontinued for irregular periods. Only 3 of the lambs were reported sick, and this was only determined by the fact that they were noticed to be scouring.

The 1916-17 results might indicate that a large consumption of grain was the cause of the illness, but it is pointed out that there are many cases where lambs consumed extra large amounts of grain and no illness resulted. There are also cases where illness occurred without the lambs having previously consumed extra amounts of grain. The author suggests "that lambs ill from dietary indiscretions may be more susceptible to other diseases."

Border Leicester sheep, J. WOOD (*Scot. Jour. Agr.*, 4 (1921), No. 4, pp. 407-413, pls. 4).—This article deals with the origin, history, description, and economic importance of Leicester sheep.

The Angora goat.—**Profitable scrub exterminator,** J. S. McFADZEAN (*Jour. Dept. Agr. Victoria*, 18 (1920), No. 2, pp. 648-657, figs. 7).—General instructions are given for Angora goat production in Australia. Their feeding, breeding, care, and management is discussed, as well as their ability in clearing scrub land.

Cumberland pigs, S. SPENCER (*Jour. Min. Agr. [London], 28 (1922), No. 11, pp. 1016-1019, pl. 1*).—An account is given of the origin and description of the Cumberland breed of hogs. A copy of the standard of excellence for the breed is also included.

Poultry experiments, observations, notes, and plans, R. H. WAITE (*Maryland Sta. Bul. 244 (1921), pp. 40, figs. 30*).—This is a report of the accumulated results of a number of experiments and observations on poultry which have not justified separate reports. Among the subjects are descriptions and plans for construction of poultry houses (E. S. R., 29, p. 371); a brooder house and storage shed for manure; rations for adult fowls; methods of computing daily feed consumption and production necessary to pay for feed; the results of feeding cottonseed meal, kiln dried corn, limestone v. oyster shells, lawn mower clippings, pop corn, and coconut meal; directions for feeding young chicks; loss of weight in shipment; wrapping eggs in tinfoil; methods of driving poultry; and weight of manure produced per day by poultry.

The limestone v. oyster shell feeding, while a preliminary report, showed that these materials were practically equal in value as determined by the breaking strength of the eggs and the thickness of the shells. The pen receiving both limestone and oyster shells, however, produced stronger and thicker shelled eggs.

Observations and methods of control for the following vices and diseases are also reported: Toe picking and nail eating among chicks, impacted gizzards, louse infection, head lice, methods of preventing white diarrhea, a chicken-killing dog, catching chicken-eating Great Horned owls, bumblefoot, roup, spraying data, worm infestation, and moldy litter as a cause of death in fowls.

1920 and 1921 experiments with poultry, E. P. and J. P. CLAYTON (*Mississippi Sta. Bul. 204 (1921), pp. 8, figs. 2*).—The results of experiments made in 1920 and 1921 to determine the relative egg production of different breeds of chickens, together with the costs and profits, the value of skim milk for egg production and as a feed for growing chicks, and the comparative returns from skim milk when fed to chickens and to pigs, are reported briefly.

Studies of egg production, cost, and profits were made with Rhode Island Reds, White Leghorns, Brown Leghorns, and Barred Plymouth Rocks. The tabulated results for the two years based only on the market value of the eggs sold showed that in 1920 the profit per hen was as follows: Rhode Island Reds \$1.20, White Leghorns \$2.26, Brown Leghorns \$1.84, and Barred Plymouth Rocks 29 cts. In 1921 the profit per bird was for Rhode Island Red pullets \$2.33, Rhode Island Red hens \$1.55, White Leghorn hens \$2.80, Brown Leghorn hens \$3.15, Brown Leghorn pullets \$2.73, and Barred Plymouth Rock hens 35 cts.

Four pens of from 14 to 16 White Leghorn pullets each were used in comparing skim milk with cottonseed meal and beef scrap as sources of protein for laying hens. All pens were fed alike except that the first received cottonseed meal, the second beef scrap, the third skim milk, and the fourth no protein in addition to that furnished by the mash which consisted of equal parts by weight of corn meal, wheat bran, and wheat shorts. The profit per hen for a period of 8 months was \$1.14, \$1.47, \$1.86, and 60 cts. for the four pens, respectively. The pen fed cottonseed meal consumed 88 lbs. of crude protein and produced 110 dozen eggs, the one fed beef scrap consumed 101 lbs. of crude protein and laid 133 dozen eggs, and the pen receiving a full feed of skim milk consumed 103 lbs. of crude protein and produced 145 dozen eggs, while the fourth, or check pen, consuming 57 lbs. of crude protein in the mash ration laid 75 dozen eggs.

Starting with two lots of 25 baby chicks each, a regular chick ration was fed, but one lot received in addition all the skim milk it would consume, while the other received only water. At the end of the first month both lots showed

the same profit per chick as indicated by the gain in weight, but at the end of 5 months the skim-milk-fed chicks had made a profit each of 65 cts. as compared with 26 cts. for the other lot. At the close of this period half of each lot was fed by the reversal method for 1 month, while the other half was continued on the original rations. The skim-milk-fed lots each made 1 lb. of gain per bird while the other two lots made less than 0.25 lb. of gain per bird.

Two lots of two pigs each fed for 45 days on the same feeds that had been fed to the chickens in the experiment just described and then fed by the reversal method for a month longer gave a value of 5 cts. per gallon of skim milk, the gains being valued at 8 cts. per pound, while with chickens worth 25 cts. per pound the skim milk returned 11 cts. per gallon.

Rations for feeding poultry in the packing house, J. S. HEPBURN, R. C. HOLDER, ET AL. (U. S. Dept. Agr. Bul. 1052 (1922), pp. 24).—This is a report of comparative rations for finishing poultry in packing houses. It deals with the amount of gain in weight of the birds and the improvement of the quality of the edible portions by the use of different rations.

Two types of experiments were carried on. One type was designated as 12-bird experiments in which different tests were made with 12 birds individually fed and recorded on each ration. The other type of experiments were called battery experiments in which larger numbers of birds were fed and records kept of the lot as a whole. Some of the battery experiments included over 1,000 birds in a lot. Both types of experiments were carried on with broilers, springs, and hens. The rations fed to control lots consisted of corn meal and buttermilk (40:60). The experimental rations were modified from this by replacing part of the corn meal or occasionally part of the buttermilk with the following substances singly or in combinations: Barley, corn meal, whole oats, oatmeal, oat middlings, oat flour, rolled oats, rice bran, rice polish, ground wheat, low grade wheat flour, wheat middlings, coconut meal, peanut flour, peanut meal with hulls, rape seed meal, soy bean meal, kafir, ground milo, alfalfa, meat scrap, semisolid buttermilk, and powdered buttermilk. The birds were weighed on the first, fourth, eighth, eleventh, and fourteenth days of the test.

The general results on increase in weight indicated that the broilers and springs did better where a high protein concentrate such as peanut meal, coconut meal, soy bean meal, or meat scrap was included in the ration. The gains made by the hens, however, were erratic. As a whole they seemed to do as well on the corn meal as when a protein concentrate was substituted.

Studies on the length of the feeding period indicate that a great deal depends upon the individual circumstances. The proportionate amounts of the gains of the different classes of birds are averaged in the following table:

Gains made in 4, 8, 11, and 14 days by different classes of birds.

Class.	Number.	Gain in 4 days		Gain in 8 days.		Gain in 11 days.		Gain in 14 days.
		Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
Broilers.....	612	12.09	30.10	22.91	57.05	31.34	78.04	40.16
Springs.....	390			17.28	59.81	21.43	84.56	28.88
Roasters.....	336	11.11	49.71	17.29	77.36	20.68	92.63	22.35
Hens.....	456	4.08	34.31	7.75	65.18	9.99	84.02	11.89

The feeding period of 14 days for broilers is certainly not too long as shown by the table, since they were still gaining rapidly at the end of that time. The springs, however, made most of their gains during 11 days, whereas the roasters and hens probably should be fed not over 6 or 8 days. Chemical analyses were made of the various parts of a large number of the birds, but no effect was evidenced by the different feeds either in affecting the composition of edible parts or loss in dressing, though there was a decided difference in dressing percentage and composition of the different classes of birds.

To show the advantage of fleshing, analyses were made of the edible parts of range birds and of birds especially fleshed. The percentage of edible parts was as follows for the birds which had not been fleshed: Broilers 53.06 per cent, springs 62.61, roasters 62.21, and hens 70.59 per cent, as compared with 60.15, 67.07, 64.46, and 71.30 per cent for the respective classes of fleshed birds.

Suggestions are also given for compounding rations for fleshing poultry.

Studies on the physiology of reproduction in the domestic fowl.—XVIII, Further observations on the anatomical basis of fecundity, R. PEARL and W. F. SCHOPPE (*Jour. Expt. Zool.*, 34 (1921), No. 1, pp. 100–118, figs. 2).—In continuation of the series on sex studies previously reported (*E. S. R.*, 38, p. 372), the visible oocytes were counted on the ovaries of 36 birds of various breeds. The number of oocytes of the four sizes into which they were graded and the total oocytes for each bird were then compared with the winter egg production and the total egg production of that bird. In general the mean number of visible oocytes on the ovaries of different kinds of birds indicates the normal fecundity of that kind of birds. Within limits the oocytes seem to increase with age though laying decreases.

Experiments in removing a portion of the ovary from 8 birds are also reported. Regeneration of the ovary seemed to produce an excessive number of oocytes in the regenerated portion.

Further information on pedigree work, H. MARTIN (*Natl. Poultry Jour.*, 2 (1922), No. 88, pp. 479–481, figs. 10).—This article gives suggestions for pedigreeing poultry supplementing those of Glendinning (*E. S. R.*, 46, p. 876). A diagram of the partitioning of the incubator as well as charts for keeping individual records are shown.

A to Z of pigeons, J. W. WILLIAMSON (*Sellersville, Penn.: Item Pub. Co.*, 1921, new ed., pp. 88, figs. 44).—This publication gives the general principles of feeding, management, breeding, marketing, and production of pigeons, as well as descriptions of the different varieties.

The American Society of Animal Production.—Record of proceedings of annual meeting November, 1921 (*Amer. Soc. Anim. Prod. Proc.* 1921, pp. 113, figs. 5).—These proceedings include the following papers, the substance of some of which have been taken from articles previously reported: Promoting Research in Animal Husbandry, by W. C. Coffey; Micrometer Calipers for Teaching the Discrimination of the Fineness of Wool, by J. A. Hill; Wintering Breeding Ewes of Mutton Type Without Grain, by C. I. Bray; Grain Sorghums v. Corn for Fattening Lambs and Steers, by J. M. Jones (*E. S. R.*, 45, pp. 60, 471); The Maximum Utilization of Silage in Fattening Baby Beeves, by C. W. McCampbell (*E. S. R.*, 46, p. 366); Native Hay as a Ranch Feed, by F. A. Hays (*E. S. R.*, 46, p. 676); The Inbreeding Problem in the Light of Recent Experimentation, by L. J. Cole; The Relation Between the Age of an Animal and the Rapidity of Its Growth, by S. Brody (*E. S. R.*, 45, pp. 378, 775); The Big Type Hog at the Market, by E. N. Wentworth; Fiber in Rations for Fattening Swine, by C. M.

Vestal; Soy Beans and Soy Bean Meal as Supplements to Corn for Hogs, by W. L. Robison (E. S. R., 45, p. 674); Hog Production Record Demonstrations in Indiana, by J. R. Wiley; Boys' and Girls' Pig Club Work, by E. L. Quaife; Swine Breeders' Associations, by E. M. Christen; The Mineral Metabolism of the Milch Cow, by E. B. Forbes (E. S. R., 40, p. 373); The Excretion of Indican and Phenols by Calves, by L. A. Maynard and L. C. Norris; Comparison of Rations for Dairy Calves, by R. S. Hulce, F. B. Morrison, and G. C. Humphrey; Hydrolyzed Sawdust for Dairy Cows, by F. B. Morrison, G. C. Humphrey, and R. S. Hulce (E. S. R., 45, p. 275); The Value of Coconut Meal as a Feed for Dairy Cows, by F. W. Woll (E. S. R., 46, p. 576); A Graphical Presentation of the Financial Phases of Feeding Experiments, by H. H. Mitchell (E. S. R., 46, p. 365); Linseed Meal and Wheat Middlings v. Tankage as Supplements to Corn for Pigs, by F. B. Morrison and G. Bolstedt; and Report of Committee on Uniform Methods of Live Stock Experimental Work, by F. G. King, H. J. Gramlich, J. M. Evvard, F. B. Morrison, and E. S. Good.

DAIRY FARMING—DAIRYING.

The feeding of dairy cattle, A. C. McCANDLISH (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, pp. XIX+281, figs. 15*).—This book reviews the principles of feeding with particular reference to dairy cattle in a nontechnical manner and then discusses the problems of practical feeding. The book may be roughly divided into three approximately equal parts dealing with principles of animal nutrition, description and use of the more common feeds for dairy cattle, and the practical feeding of dairy cattle. The appendix includes tables giving the digestible nutrients and minerals in the more common feeds and feeding standards for dairy cattle, as well as tables showing the cost of digestible crude protein in the more common dairy cattle feeds.

Dairy calves.—Consumption of food and gain by different breeds, E. BRINTNALL (*Mississippi Sta. Bul. 200 (1921), pp. 16*).—This reports experimental work to determine the relative rate of growth and the amount of food that was consumed in making this gain by calves of three dairy breeds. For this test, which was begun on November 27, 1920, and continued until the calves were six months of age, the following were used: Four Ayrshire bull calves 20 and 6 days old, and 2 which were born on November 29 and December 1, 2 Holstein heifer calves born on November 26 and 27, and 4 Jersey calves, 3 of which were bulls, 32, 32, and 24 days of age, and 1 Jersey heifer 17 days of age. The calves were given warm whole milk until 4 weeks old, when they were gradually changed to skim milk, the amount varying from 8 lbs. at the start to 12 lbs. at the close of the test.

Grain (cracked corn and oats 1:1) and hay (Johnson grass with a little alfalfa) were kept before the calves at all times until they ate 2 lbs. of grain per day, and later the allowance of grain was increased to 3 lbs. per day. The calves were weighed at birth and weekly thereafter. The individual gains are reported, as well as the average grain, hay, and milk consumed by the calves of each breed by weeks. The table following gives a summary of the average grain and hay consumed and the total gains made for the calves of each breed during the six months' test.

Average gains, and grain and hay consumed by Holstein, Ayrshire, and Jersey calves to 6 months of age.

Breed.	Average gain.	Grain consumption		Hay consumption.	
		Average.	Per lb gain	Average.	Per lb. gain.
	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Holstein.....	249.75	292.5	1.171	690.5	2.765
Ayrshires.....	234.9	277.875	1.183	539.44	2.296
Jerseys.....	170	212.9	1.252	423.56	2.49

It may be noted that the gains made were in order of the mature weights of the breeds. It was determined from the weekly gains and food consumed that calves depend almost entirely on milk during the first 4 weeks, as very little or no hay or grain was eaten previous to that time.

General information is also given on the care, management, feeding, and diseases of calves.

A study of nitrogen metabolism in the dairy cow, C. CROWTHER and H. E. WOODMAN (*Jour. Agr. Sci. [England]*, 12 (1922), No. 1, pp. 40-56).—In the first of two nitrogen metabolism experiments with cattle, two Shorthorn cows, dry and not pregnant, were used during 8 periods of from 21 to 36 days each. During the first period each cow was fed 14 lbs. of "seeds" hay, with a loss of 8.2 gm. of nitrogen per day by one cow and a gain of 5 gm. by the other. During each successive period 2 lbs. of corn meal was added to the ration. During the fourth period the cows were receiving 14 lbs. of hay and 6 lbs. of corn meal per day, which gave an intake for each cow of 164.3 and 168.4 gm. of nitrogen, with a nitrogen retention of 20.4 and 20.6 gm. per day. Unfortunately in period 5 the quality of the hay was changed which modified the results from then on. The experiment indicates that under the conditions of the test the optimum protein supply for storage was about 2.4 kg. of crude protein, or 1.7 kg. of digestible crude protein, per 1,000 kg. live weight.

In the second experiment, which lasted 722 days, two Shorthorn cows were also used. During the entire experiment one cow was dry and nonpregnant, whereas the other cow was dry and not in calf for the first 302 days, in calf for 284 days, and milking for 136 days. Samples for nitrogen balance determinations were taken from both cows for 546 of the 722 days of the test. During this test 20 lbs. of "seeds" hay was fed per day, the crude protein composition of which varied from 10.27 to 12.86 per cent. The results are reported in periods of 18 days and summarized into periods corresponding to those mentioned for the cow which was bred.

The results indicated that when the cows are maintained on a ration causing nitrogen retention, the amount of retention falls daily until finally nitrogen equilibrium is maintained, but considerable variation may arise from time to time. In the earliest days of pregnancy marked changes in nitrogen metabolism occurred. During parturition there was found to be a great output of nitrogen. It was found necessary for the milching cow to supply two or three times as much nitrogen as is secreted in the milk in addition to that required for normal equilibrium in the dry cow in order to maintain nitrogen equilibrium.

Silage for dairy cows, G. S. ROBERTSON and F. J. PITCHER (*Jour. Min. Agr. [London]*, 28 (1921), No. 6, pp. 506-515, figs. 2).—An experiment is reported with 11 milch cows which were divided into two lots of 5 and 6 each for feeding tests. For 28 days, beginning December 6, lot 1 received a daily ration of 50 lbs. of mangolds, 10 lbs. of meadow hay, 18 lbs. of oat straw, 4 lbs. of dried

ale grains, and 5 lbs. of concentrates per head, and lot 2 received 50 lbs. of silage (mixture of tare, oat, and beans), 10 lbs. of hay, 4 lbs. of dried ale grains, and 3 lbs. of concentrates. During the next 28 days the rations were reversed. The total amount of milk produced by the two lots on the mangold ration was 8,730 lbs. as compared with 8,873 lbs. on the silage ration. The silage ration was also the cheaper.

A comparison of silage and soiling crops for summer milk production, A. C. McCANDLISH (*Iowa Sta. Bul. 201 (1921), pp. 3-8*).—Two experiments in keeping up milk production with soiling crops and silage during the summers of 1918 and 1919 are reported.

During 1918, 41 cows were used in the test. The summer was divided into three periods of 30 days each. Soiling crops were fed during the first and third periods and silage during the second period. During the summer of 1919 the periods were 42, 36, and 30 days, respectively. Nineteen cows were used in this test. Silage was fed during the first and third periods and soiling crops during the second period. The effects of these two succulent feeds on the milk production were measured by averaging the productions during the first and third periods and comparing this average with the production during the second period. During the 1918 experiments the soiling crops produced 3 per cent more milk and 6 per cent more fat than the silage. During 1919 the silage produced 3 per cent more milk and 5 per cent more fat than the soiling crops.

The author concludes that soiling crops or silage can maintain an equal level of milk production, but it requires 75 per cent more weight of soiling crops than of silage to maintain the same production. Silage is concluded to be more economical if the price of corn is low, but with silage at \$7 per ton and soiling crops at \$4 per ton the cost of milk production would be the same. Reference is made to similar experiments previously reported (*E. S. R.*, 41, p. 181).

Has the time of calving any influence on the year's milk production? SCHMIEDER (*Deut. Landw. Tierzucht*, 25 (1921), No. 5, p. 46).—In studying the milk records of four herds, one of which was composed of 71 cows and the other three of a total of 82 cows, the average yearly milk production for cows calving in the different months of the year was found to be as follows: April and May 2,418 and 2,380 kg., June 2,051 and 2,075 kg., July to September 2,142 and 2,177 kg., October to November 2,280 and 2,241 kg., December to January 2,081 and 2,326 kg., and February to March 2,133 and 2,261 kg., respectively, for the two groups. In all cases the grazing season began June 1 and ended about December 1.

Vitamin studies.—IX, The influence of the diet of the cow upon the quantity of vitamins A and B in the milk, C. KENNEDY and R. A. DUTCHER (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 339-359, figs. 10).—This is the ninth paper of this series (*E. S. R.*, 46, p. 469).

The results of experiments to determine the quantities of cow's milk necessary to supply sufficient vitamins for normal growth in rats indicate that, if the cows receive a ration containing an adequate amount of vitamins A and B, 10 cc. of the milk produces normal growth, but that 5 cc. will not supply either vitamin A or B in sufficient amounts for normal growth.

In carrying on these experiments two cows were fed on feeds poor in vitamins and were found to produce vitamin-poor milk. The milk produced by the regular Minnesota herd was used as normal milk, since these cows were receiving rations containing adequate amounts of vitamins. Even 15 cc. of the milk from cows receiving low vitamin feed would not supply sufficient vitamins for growth. Summer pasture was also found not to help supply sufficient vitamins in the milk unless it was fresh and green.

Note on the composition of a fluid obtained from the udders of virgin heifers, H. E. WOODMAN and J. HAMMOND (*Jour. Agr. Sci. [England]*, 12 (1922), No. 1, pp. 97-102).—In a study of the fluid found in the udders of virgin heifers, the occurrence of this fluid appeared to be somewhat dependent upon the estrus cycle. The composition of this fluid was found to resemble colostrum more closely than milk.

The change in ewe's milk during the lactation period, S. WEISER (*Landw. Vers. Sta.*, 97 (1920), No. 1-2, pp. 131-140; *abs. in Zentbl. Gesam. Landw.*, 2 (1921), No. 10, pp. 378, 379; *Chem. Zentbl.*, 1921, III, No. 1, p. 76).—Analyses were made of the milk of two Friesian ewes from March 22 to September 15. The average amounts of milk given per day by each ewe during April were 1.5 and 1.35 liters and during September 0.3 and 0.2 liters, respectively. From the first to the last part of the lactation the average specific gravity of the milk ranged from 1.0342 to 1.0397, dry matter 12.97 to 19.9 per cent, fat 3.5 to 7.85 per cent, milk sugar 4.83 to 3.69 per cent, ash 0.72 to 0.91 per cent, crude protein 3.91 to 7.42 per cent, casein 3.18 to 5.91 per cent, and albumin and globulin 0.31 to 1.24 per cent. The morning milk was found to be thinner than the evening milk, the specific gravity and fat percentage of the evening milk being almost always higher. Results obtained by other investigators are reported and compared with the results given by the author.

Studies on the biology of lactic acid bacteria: A summary of personal investigations, C. GORINI (*Jour. Bact.*, 7 (1922), No. 2, pp. 271-276).—This is an English summary of the work done by the author at the bacteriological laboratory of the Royal Superior School of Agriculture, Milan, Italy, from 1914 to 1920, on the biological characters of lactic acid bacteria. A similar paper in German has been reported (*E. S. R.*, 45, p. 476).

The bacteria of milk.—The common species of milk-fermenting bacteria frequently found in milk. The glairy form of *Streptococcus lacticus*, H. VIOLÆ (*Ann. Inst. Pasteur*, 35 (1921), No. 3, pp. 218-229, figs. 2).—This is the report of a study of the characteristics of a *Streptococcus* commonly found in milk, butter, and cheese at the Paris markets. It seems to have most of the characteristics of *S. lacticus*, though there appear to be some differences in cultural characters.

The use of domestic methylene blue in staining milk by the Breed method, W. A. WALL and A. H. ROBERTSON (*Jour. Bact.*, 7 (1922), No. 2, pp. 307, 308).—Since some difficulty has been experienced in staining milk by the Breed method, tests have been performed at the New York State Experiment Station to determine how these difficulties may be overcome. Five samples of methylene blue, unsatisfactory for staining milk because they dissolved the film, were obtained. It was found that by adding a small amount of CaCO_3 , Na_2CO_3 , or better NaHCO_3 , to the aqueous solutions of these samples that they were rendered satisfactory for this work. Alcoholic solutions of methylene blue are preferred to aqueous solutions, however, because of their freedom from contamination.

Partial neutralization of acidity of cream before pasteurization as a factor in butter making, W. H. SPROULE and M. GRIMES (*Ontario Dept. Agr. Circ.* 38 (1921), pp. 12; also in *N. Y. Prod. Rev. and Amer. Creamery*, 53 (1921), No. 9, pp. 417-422; 53 (1922), No. 10, pp. 465-469).—Averages of 50 experiments on the effect of the acidity of cream on the loss of fat in the buttermilk showed that with 0.35 per cent or less of acidity there was 0.133 per cent of fat in the buttermilk, with 0.35 to 0.4 per cent of acidity 0.2 per cent of fat, with 0.45 to 0.5 per cent of acidity 0.335 per cent of fat, and with over 0.5 per cent of acidity 0.522 per cent of fat.

In a comparison of 11 different samples of cream, one part of each sample being partially neutralized and the other not neutralized, it was found that the average percentage of fat in the buttermilk from unneutralized cream was 0.72 per cent and from neutralized cream 0.45 per cent. The score and quality of the butter from the unneutralized cream, especially after storage, was not quite so good as that from the partially neutralized cream.

Gouda cheese manufactured from pasteurized milk, J. P. Gow (*Union So. Africa Dept. Agr. Jour.*, 3 (1921), No. 4, pp. 334-336; also in *N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), No. 10, pp. 470-472).—An experiment in the manufacture of Gouda, or sweet milk cheese, from pasteurized milk is reported from South Africa. The fresh milk was pasteurized at 145° F. for 10 minutes, cooled to 86°, and placed in the cheese vat, where it was handled as usual. The results of the pasteurization were mainly in doing away with the gas bubbles which are so common in South African cheese. Cheese made from similar milk unpasteurized contained gas bubbles and was not of as good flavor, texture, or color and scored eight points less than the cheese from pasteurized milk.

VETERINARY MEDICINE.

Handbook of tropical diseases.—VI, Tropical diseases of domestic animals, P. KNUTH and P. J. DU TOIT (*Handbuch der Tropen-Krankheiten.—VI, Tropen-Krankheiten der Haustiere. Leipzig: Johann Ambrosius Barth, 1921, 2. ed., vol. 6, pp. XVI+889, pls. 4, figs. 143*).—The subject is dealt with under the headings of diseases caused by protozoa (pp. 1-587), by ultravisible viruses (pp. 588-701), by bacteria (pp. 701-717), by fungi (pp. 717-748), by roundworms and insects (pp. 749-783), by plant poisons (783-813), and by unknown diseases (pp. 813-853). A classified bibliography (pp. 854-862), a list of handbooks and textbooks, monographs, etc., relating to tropical diseases of domestic animals, and a list of the journals dealing with the same (pp. 862-865), together with author and subject indexes, are included.

Report of the New York State Veterinary College at Cornell University for the year 1920-21 (*N. Y. State Vet. Col. Rpt., 1920-21, pp. 257, pls. 21*).—The papers presented in this report are as follows: Researches upon the Diseases of Breeding Cattle, by W. L. Williams (pp. 54-66); The Bacteriology of the Female Reproductive Organs of Cattle and Its Relation to the Diseases of Calves, by C. M. Carpenter (pp. 67-107); Genital Infections in the Bull, by H. L. Gilman (pp. 108-117); Diagnosis and Treatment of Diseases of the Digestive System in Cows (pp. 118-123), Traumatic Gastritis in Ruminants (pp. 124-130), and Some Results of the Treatment of the Genital Tract of Cows (pp. 131-142), all by D. H. Udall; *Bacterium suisepitium* as a Factor in Pneumonia of Swine, by R. R. Birch and J. W. Benner (pp. 143-172); Further Study of the Etiology of an Undiagnosed Disease of Cattle, by W. A. Hagan (pp. 173-180); Calcification of the Ligamentum Nuchae, by H. L. Van Volkenberg (pp. 181-189); Acute Exudative Meningo-encephalitis in Domestic Animals, by S. A. Goldberg (pp. 190-195); A Survey of the Sheep Diseases of New York, by H. A. Hoffman (pp. 196-214); The Cause and Treatment of Rickets, by H. J. Milks (pp. 215-220); Hexamethylenamin: A Brief Review and Its Therapeutic Efficiency in Veterinary Medicine, by M. A. Tubangul (pp. 221-229); The Ultraparticles of the Blood and Chyle, by S. H. Gage and P. A. Fish (pp. 230-235); The Tonsils of the Dog, by E. Sunderville (pp. 236, 237); and Fatty Degeneration in the Parenchymatous Organs of Domestic Animals, by S. A. Goldberg and M. A. deSouza (pp. 238-251).

A guide to the poisonous plants and weed seeds of Canada and the northern United States, R. B. THOMSON and H. B. SIFTON (*Toronto: Univ. Toronto Press, 1922, pp. 169, figs. 40*).—The several sections of this work deal with the plants dangerous when included in hay and coarse feeds (pp. 17-45), plants dangerous in pasture or on the range (pp. 46-89), plants dangerous in ground feeds (pp. 90-108), and poisonous plants which are rarely observed to cause death in animals (pp. 109-149). A symptoms key to the principal poisonous plants (pp. 151-154), a glossary, and an index are included.

Comparative microscopic investigations of the hair of the horse, ox, dog, and cat, G. ENNEKER (*Vergleichende Mikroskopische Untersuchungen der Haare von Pferd, Rind, Hund, und Katze. Inaug. Diss., Tierarztl. Hochsch. Hannover, 1919, pp. 48, pls. 3*).—This inaugural dissertation reports the results of a histological study conducted by the author and presented at the Veterinary High School at Hannover.

The development of the cloaca in birds, with special reference to the origin of the bursa of Fabricius, the formation of a urodacal sinus, and the regular occurrence of a cloacal fenestra, E. A. BOYDEN (*Amer. Jour. Anat., 30 (1922), No. 2, pp. 163-201, figs. 41*).—This is a review of the development of the cloaca in bird embryos from the third to the fifteenth day of incubation, and is based on the study of a large number of chick embryos supplemented by observations on three other species of birds. The paper includes a bibliography of 28 titles.

An epizootic of foot-and-mouth disease in the Province of Ferrara in 1919 and 1920, V. GRILLI (*Agr. Ferrarese, 26 (1921), Nos. 11, pp. 127-129; 12, pp. 136-138; 13, pp. 149, 150; 14, pp. 169-171; 15, pp. 183-185; 16, pp. 198-200; 17, pp. 214-216; 18, pp. 231-233*).—A detailed account of the occurrence of foot-and-mouth disease in the Italian Province of Ferrara.

Possible duality of foot-and-mouth disease (working hypothesis), SCHEIN (*Compt. Rend. Acad. Sci. [Paris], 174 (1922), No. 3, pp. 204-207*).—The possibility is suggested of there being two forms of foot-and-mouth disease, one being very virulent, of short incubation period, and capable of being transmitted to man and swine, and the other of longer incubation period, non-transmissible to other species, and more benign in its course. Although it is considered that the evidence on this point is as yet insufficient, it is thought to be worthy of consideration, particularly from the point of view of immunization.

Immunity against foot-and-mouth disease, H. VALLÉE and H. CARRE (*Compt. Rend. Acad. Sci. [Paris], 174 (1922), No. 3, pp. 207, 208*).—A further suggestion of the possibility of more than one form of foot-and-mouth disease, as noted above, is given in the report of a series of experiments in which heifers cured of natural or experimental foot-and-mouth disease caused by the same virus were tested by inoculation or natural exposures with a virus recently imported from Germany and with the French virus responsible for the original infection. In the former group all of the animals became reinfected, while no cases developed in the animals of the other group.

Pleuropneumonia contagiosa bovm (lung sickness), and the preventive method of inoculation, J. WALKER (*Kenya Colony Dept. Agr. Bul. 2 (1921), pp. 136-181*).—This is the report of an extensive study of contagious bovine pleuropneumonia and of methods of immunization and diagnosis.

The method recommended is the subcutaneous inoculation in the tail of 0.5 cc. of a pure culture in Martin's bouillon of the organism of bovine pleuropneumonia. A local reaction manifesting itself by heat, tenderness, and swelling commences in from 8 to 14 days. As soon as this reaction begins the

skin of the tail is cauterized in a ring about 6 in. above the swelling to prevent the spread of the infection. Generally speaking, the inoculation of an infected animal does not produce a reaction, so that an animal which reacts is considered to be noninfected. Exceptions to this are cases in which an animal which may be refractory to an original inoculation may react when reinoculated after a lapse of some time, or a noninfected animal may possess a natural resistance and not react, and an animal may be in the incubative stage of the disease and yet react. The immunity acquired by an animal reacting to the test is thought to last about a year.

The antirabic vaccination of herbivora, G. FINZI and A. RONDELLI (*Clin. Vet., Ross. Poligia Sanit. e Ig.* [Milan], 43 (1920), No. 17-19, pp. 457-463).—The authors report the successful antirabic vaccination of a horse by three subcutaneous injections at 4-day intervals of an emulsion in distilled water of fixed virus which had stood for 72 hours in ether and a fourth injection two days later with an emulsion of virus which had stood for 48 hours in ether. In the case reported the first treatment was not given until 12 days after the animal had been bitten. In general the treatment recommended consists in two injections at intervals of 3 days of emulsions of virus which have been shaken in ether for 72 hours, a third injection after another interval of 3 days of a 60-hour ether extract of virus, and a final injection 3 days later with a 48-hour ether extract of virus.

The production of virus for the hyperimmunization of cattle to furnish serum against rinderpest, J. NICOLAS and P. RINJARD (*Compt. Rend. Soc. Biol.* [Paris], 85 (1921), No. 23, pp. 166-168).—The authors state that in their experience the blood of animals suffering from rinderpest is virulent at all stages of the disease, and consequently is suitable for hyperimmunization purposes at other than the first febrile stage. Based on this observation, the following method is used for obtaining the virus:

As soon as the fever is definitely established the animals are bled into a sterile receiver containing a suitable amount of sodium citrate. The quantity of blood drawn varies from 3 to 5 liters, depending upon the size of the animals. As soon as the blood has been drawn a volume of physiological salt solution at 37° C. equal to that of the blood drawn is siphoned into the jugular vein of the animal by the same tube. This operation of bleeding and injection is repeated after an interval of 24 hours and a third time if possible, after which the animals are bled to death. The amount of blood obtained in this way is considerably larger than can be obtained at a single bleeding.

The action of "Bayer 205" on *Trypanosoma equiperdum* in experimentally infected mice, C. M. WENYON (*Brit. Med. Jour.*, No. 3175 (1921), p. 746).—This is a report of experiments conducted with the drug known as "Bayer 205," accounts of the trypanosomicidal action of which were published by Haendel and Joetten¹ and Mayer and Zeiss² in 1920. The authors of both of the papers referred to reached the conclusion that the preparation possessed a trypanosomicidal action on various pathogenic trypanosomes in small laboratory animals, small doses having cured mice, rats, guinea pigs, and rabbits infected with *T. brucei*, *T. equiperdum*, *T. equinum*, *T. gambiense*, and *T. rhodesiense*.

In the author's experiments it was tested on a very virulent strain of the dourine trypanosome (*T. equiperdum*) in mice. "The animals were inoculated intraperitoneally from another heavily infected animal. In 48 hours the blood showed very heavy infections, and if left untreated the animals died on this

¹ Berlin. Klin. Wehnschr., 57 (1920), No. 35, pp. 821-823.

² Arch. Schiffs u. Tropen Hyg., 24 (1920), No. 9, pp. 257-294.

or the following day. In all cases the drug was given 48 hours after inoculation by the intravenous route when trypanosomes were swarming in the blood. It was found that a dose of 0.0025 gm. per kilogram of body weight would cause the trypanosomes to disappear, but that relapse occurred in about one week, the animals then dying of very heavy infections two or three days later. A dose of 0.005 gm. per kilogram of body weight, however, has not been followed by any relapse during 10 weeks' observation. The mice are quite healthy, and from what I know of the action of other trypanosomicidal drugs, if relapse is to occur, as is practically always the case, it does so in mice within 10 days. It may fairly safely be assumed that the minimal dose required to produce this apparent sterilisans magna in mice lies between 0.0025 and 0.005 gm. per kilogram of body weight if the drug is administered intravenously."

The intradermic tuberculin test, O. AUGSPURGER (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 340-345, figs. 3).—Suggestions with illustrations are given for the application of the intradermal tuberculin test.

Pennsylvania instructions for the ophthalmic tuberculin test, T. E. MUNCE (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 6, pp. 734, 735, fig. 1).—This is a copy of the instructions issued by the Bureau of Animal Industry, Pennsylvania Department of Agriculture, to bureau agents and practicing veterinarians with regard to the ophthalmic tuberculin test.

Studies on the effects of tuberculin, P. M. HOLST (*Jour. Hyg. [London]*, 20 (1921), No. 4, pp. 342-359, figs. 2).—This investigation consisted of studies of the effects of tuberculin on the healthy organism, of the nature of the alexin in tuberculous sera and its combination with antigen and antibodies, and of the action of tuberculin on the leucocytes of normal and tuberculous blood.

Tuberculin injected intravenously into normal rabbits was found to disappear rapidly from the vascular system and to reappear in the urine only after several hours. Evidence is advanced that in the meantime the tuberculin is bound in the organism, probably in the bones and in the liver.

The hypothesis of plurality of complements is supported by complement fixation tests with different sera. A difference was also noted between tuberculous and nontuberculous complement.

Tuberculin proved highly toxic to leucocytes, particularly from tuberculous subjects. "A certain protective power in regard to the toxic action of tuberculin is found in the serum. This power is greater in serum from normal organisms than in serum from tuberculous organisms."

Studies in the diseases of the reproductive organs of cattle, E. T. HALLMAN (*Michigan Sta. Tech. Bul.* 54 (1921), pp. 3-23, pls. 6).—This report is in two parts.

I. *A preliminary report on the pathology of pyometra in cattle* (pp. 3-10).—This is a report of four cases from two herds in which abortion disease has caused more or less loss for the last six or eight years. It is pointed out that little, if any, work has been done on the pathology of this condition in cattle. "In three of the four cases studied a superficial more or less general necrosis of the mucosa with leucocytic infiltration and fibrosis of the superficial portions of the stroma were observed. The necrotic zone varied in depth from 50 μ to 0.8 mm., and in places produced many minute ulcers extending more deeply into the uterine mucosa. Both the gland mucosa and the region of the cotyledons were involved in the necrotic process. The glandular changes as a whole were not marked, although in places there were degenerative and disintegrative changes in the glandular epithelium with leucocytic infiltration of the gland luminae. In one of these cases numerous thrombi were seen in the small blood vessels of the mucosa more or less completely plugging them. The lesions ob-

served in these cases bear considerable resemblance to those caused by the injection of concentrated preparations of iodine into the uterine cavity. In the latter case there is the important difference, however, that the principal irritant is quick in its action and is active for only a short period of time. In pyometra the irritation is continuous over a longer period of time. This condition obviously produces more fibrosis.

"In one of the cases studied the most conspicuous alteration was the presence of numerous small cysts in the uterine mucosa. This condition may explain failure to breed and nymphomania in those cases in which clinical examination fails to reveal cystic ovaries. Obviously these small cysts in the uterine mucosa could not be detected clinically. It is possible that many of them might be crushed by massage. In this case there was some necrosis of the epithelium with leucocytic infiltration and some fibrosis of the stroma. Over some of the cotyledons the epithelium was stratified, the outer layers of which were apparently undergoing cornification. Sven Wall, of Sweden, has reported this condition not only of the cotyledon but also of the gland mucosa, and believes that it results from a growing in of the ectodermic epithelium from the vagina. Since this condition was not observed in the gland mucosa of the case studied by the author, he is inclined to look upon it as not the result of a growing in of the epithelium from the vagina but more likely the result of constant irritation of a relatively low degree of the epithelium of the cotyledon.

"The alterations observed in these cases suggest the thought that the most helpful treatment is that which would provide constant drainage and prevent putrefaction of the necrotic tissue."

II. *Some observations on the anatomical effects of medicinal agents on the uterine mucosa of the cow* (pp. 11-21).—These studies were made in an effort to throw some light on changes produced in the uterine mucosa by the application of the treatment usually employed by gynecologists for the chronic catarrhal conditions of the uterus. The primary object was to make observations on the damages wrought by such treatment and the extent of repair of the uterine mucosa. Two preparations were used, namely, (1) Lugol's solution of iodine and (2) a preparation consisting of menthol crystals 2 dr., tincture of iodine 2 oz., and glycerine 2 oz. Five cases upon which studies were made are reported.

"The injection of 1 oz. of Lugol's solution of iodine, either undiluted or diluted, with an equal volume of water into the uterine cavity of the cow produces an acute fibrinous endometritis with superficial necrosis of the mucosa varying in depth from 20 μ to 1 mm. Injection of 1 or 2 oz. of menthol-iodine-glycerin has the same effect. Marked superficial necrosis is apparent the day following injection, and sloughing of the necrosed tissue by a process of liquefaction necrosis is observed in 48 hours after treatment. Regeneration of the epithelium may be observed as early as 78 hours after treatment, resulting in the partial covering of the eroded surface before the necrotic zone is completely detached. This covering of epithelium results from a proliferation of the epithelium lining the gland ducts in case the superficial epithelium has been completely destroyed. Other than marked edema and engorgement of the blood vessels, there is but little evidence of the effects of such treatment upon the deeper portions of the uterine mucosa.

"Out of 10 cases treated there were 3 in which the treatment apparently caused the rupture of a blood vessel, resulting in a hematoma. In one of these the cow was in heat, in another there was evidence of menstruation, and the third was pregnant. In view of the fact that in each of these conditions there is an engorgement of the blood vessels, the thought is suggested that such

treatment about the time of estrum or menstruation may be a dangerous practice."

Infectious abortion of cattle and its possible relation to human health, L. E. W. BEVAN (*Vet. Rec.*, 33 (1921), No. 1746, pp. 1005-1012; also in *Rhodesia Agr. Jour.*, 18 (1921), No. 6, pp. 582-594).—In the course of this discussion the author states that a number of cases have recently occurred in Rhodesia among human beings who have shown the clinical manifestations of Malta fever and who, as far as can be ascertained, have not imbibed goats' milk, but have resided on farms where infectious abortion of cattle is known to exist. While circumstantial evidence points to infection through infected cattle direct proof is not yet available.

The treatment of diarrheal enteritis in calves, J. DARNAUD (*Rev. Vét. [Toulouse]*, 72 (1920), No. 12, pp. 743-746).—The administration of iodin prepared by adding three or four drops of tincture of iodin (10 per cent) to four spoonfuls of gruel, to which a pinch of flour is added, has given excellent results when administered to the animals five times a day in the intervals between suckling. The preparation should be freshly prepared each time just before use.

Stomach worms in sheep, J. E. GUBERLET (*Oklahoma Sta. Bul.* 137 (1921), pp. 3-16, figs. 5).—This is a summary of information upon the history and distribution of the stomach worm (*Haemonchus contortus*) in sheep, its life history and bionomics, effects upon the host, and prevention and means of treatment. Of the several remedial measures tested at the station laboratory, the two most successful remedies were (1) the use of a 1 per cent solution of copper sulphate and (2) a solution containing 1 per cent copper sulphate and 1 per cent of tobacco infusion. The copper sulphate alone removed 75 to 97 per cent of the worms, while copper sulphate and tobacco together removed 90 to 100 per cent.

"When copper sulphate is used alone it does not seem to remove the worms as quickly as the combination of copper sulphate and tobacco. It has also been observed that copper sulphate and tobacco are somewhat more effective than copper sulphate alone in removing tapeworms (*Moneszia* sp.) and hookworms (*Bunostomum trigonocephalum*), in addition to the stomach worms. With a single exception, every case known to be infested with tapeworms that was treated with copper sulphate and tobacco and later autopsied showed none of these worms to be present. In that case all of the worms were detached, and some of them might have passed out had the animal lived longer. Death was produced from screw worm infestation along with the weakened condition brought on by stomach worms."

The copper sulphate should be made up into a 1 per cent solution for drenching, as described in the circular previously noted (E. S. R., 42, p. 381). The copper sulphate and tobacco should be made as follows: "Dissolve 0.25 lb. (avoirdupois) of the powdered crystals of copper sulphate (bluestone) in 0.5 gal. of boiling water, using porcelain or enamelware dish. Put 0.25 lb. of finely ground or powdered tobacco (tobacco snuff) into 0.5 gal. of boiling water, cover, and let stand over night. In the morning mix the two solutions in a wooden, earthenware, or nonmetallic receptacle and add 2 gal. of cold water. This makes a solution of proper strength to use and will be enough to dose 100 adult sheep or 200 lambs, allowing 10 per cent waste." The dosage of either copper sulphate or copper sulphate and tobacco are the same, namely 1.75 oz. for lambs under 1 year of age and 3.5 oz. for sheep past 1 year of age. The drenching apparatus is described and illustrated.

Clarification of hog cholera defibrinated blood antitoxin, R. R. HENLEY (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 6, pp. 717-723).—A method which

has been found satisfactory for clarifying and concentrating old phenolized defibrinated blood antitoxin for hog cholera is described. The principal feature of this process, as distinguished from the method of Dorset and Henley (E. S. R., 35, p. 488), which is applicable only to fresh, nonphenolized, defibrinated or citrated blood, is the use of chloroform to precipitate the dissolved hemoglobin following the precipitation of cells and stromata by bean extract as in the original method. The precipitation of the hemoglobin with chloroform was found to be complete if the blood contained at least 0.5 per cent of phenol, the temperature of the blood did not exceed 40° F. when the chloroform was added, and the mixture of blood and chloroform was thoroughly shaken. Following the addition of the chloroform, the serum may be separated from the clot by centrifugation or by filtration. If the latter process is used, the material should first be shaken in a shaking machine after the addition of 5 gm. of salt for each 500 cc. of blood. The clear serum is heated as in the original Dorset-Henley method and sufficient phenol added to bring the concentration to 0.5 per cent. The technique of the procedure is described in detail, with precautions that must be observed to insure good results.

Data are given showing that the yield of clarified serum separated by this process approximates 70 per cent of the original volume. The product is free from bacterial contamination, and potency tests indicate that the loss of antibodies during clarification is very slight.

Suggestions for handling recently vaccinated swine to eliminate bad results, H. M. GRAEF (Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 3, pp. 346-357).—In the opinion of the author much of the trouble often following hog cholera immunization, the so-called vaccination break, is due to decreased resistance of the animals which permits the action of secondary invaders. To enable the animals better to withstand the immunizing process, it is emphasized that attention should be paid to the diet and handling of the herd. Recently immunized swine should be kept in clean quarters and fed lightly for several days, the amount of feed being increased very slowly.

"Segregation of all sick animals and revaccination with large doses of serum are advised when breaks occur. Revaccination of entire herd with serum depends on history, symptomatology, virulence of break, and character of post-mortem lesions. The plentiful use of disinfectants is advocated. The use of virus in revaccination is not advocated, as a stimulation of body tissues tends to exaggerate the diseased condition. Counteract the primary disease process by passive immunity, and secondary invaders will in most instances be destroyed by whatever cell activity the body is able to produce."

Stephanurus dentatus as a parasite of swine in Guiana, L. ROUSSEAU (Bul. Soc. Path. Exot., 14 (1921), No. 4, pp. 219-222).—The kidney worm is said to be widespread in Guiana.

The effect of heat on horse serum in the Bordet-Gengou reaction for the diagnosis of dourine, A. BESSEMANS (Compt. Rend. Soc. Biol. [Paris], 85 (1921), No. 32, pp. 889, 892, figs. 2).—Evidence is presented that normal horse serum contains in varying amounts certain substances capable of causing a non-specific complement deviation in this test for dourine, but that this complication may be avoided by heating the serum at 60° C. for one-half hour before making the test.

Comparative value of different methods of preparing the antigen for the Bordet-Gengou reaction for the diagnosis of dourine, A. BESSEMANS (Compt. Rend. Soc. Biol. [Paris], 86 (1922), No. 5, pp. 289-292).—A comparison is reported of the antigenic values of aqueous or alcoholic extracts of organs of animals which have succumbed to trypanosome infection and of the blood of

animals infected with virulent trypanosomes. The former antigens are thought to have too weak and variable a specificity. Of the latter, extracts prepared by partial centrifugation and by hemolysis are recommended.

Progress in combating poultry diseases in the United States, J. H. BEACH (*Cornell Vet.*, 11 (1921), Nos. 3, pp. 191-200; 4, pp. 229-263, figs. 21).—This is a summary of information on poultry diseases in connection with a list of 138 references to the literature.

RURAL ENGINEERING.

[Engineering research], C. F. JENKIN (*Brit. Assoc. Adv. Sci. Rpt.*, 88 (1920), pp. 125-134).—This address emphasizes the importance at this time of engineering research, and points out some of the more important deficiencies in basic theories relating particularly to materials of construction. The conclusion is drawn that "the time has come when the fundamental data on which the engineering theories of the strength and suitability of materials are based require thorough overhauling and revision."

First biennial report of the Department of Reclamation, State of Idaho, W. G. SWENDSEN (*Idaho State Dept. Reclam. Bien. Rpt.*, 1 (1919-20), pp. 246).—This report deals particularly with water resources, irrigation and irrigation structures, irrigation legislation, and hydrometric work.

Field experiments on a practical irrigation rating box, C. C. JACOB and H. R. LEACH (*Engin. News-Rec.*, 88 (1922), No. 13, pp. 530, 531, figs. 2).—Studies conducted at the Uintah Basin Irrigation project on the modification of rating flumes on certain of the main canals to prevent nonuniformity in ratings due to silting above or below the flumes are reported. This was accomplished by throttling the flow through the flume at the lower end by means of wings projecting into the flume at right angles to the sides, the opening between the wings being in general one-half of the original width of the flume. The experiments led to the permanent adoption of a simple, rectangular flume of a length four times its width, contracted as stated, and designed to have a free overfall at the discharge end similar to an irrigation drop.

Experiments with four different boxes with widths of 2, 3, 4, and 5 ft. led to the determination of the formula for flow, $Q = 3.69LI^{1.48}$, in which Q is the discharge in second-feet, L is the width of the notch in feet, and H is the head on the notch measured a distance equal to the width of the box above the notch. This formula was found to give the discharge of the box up to a head equal to the width of the notch. In only 5 out of 134 observations made under standard conditions did the discharges computed by the formula differ from the observed discharges by more than 0.1 sec.-ft.

Metal and wood contractions gave the same rating. No difference in the rating of boxes of a length either three or four times the width could be detected in the cases of the 2- and 3-ft. boxes. In the case of the 4-ft. box the discharge was somewhat lower for the short box. A slight change in the ratio of notch width to box width did not materially affect the rating. Submergence decreased the discharge, but it required a submergence of 25 per cent of the head to decrease the apparent discharge 5 per cent. It required material obstruction at the entrance to change the rating appreciably.

Thin concrete lining successful in irrigation canals, R. C. E. WEBER (*Engin. News-Rec.*, 88 (1922), No. 11, pp. 436, 437, figs. 3).—Experience since 1911 on the use of thin concrete canal linings is briefly presented, showing that such linings, 1.5 in. thick, placed on 64 miles of the main distribution system of the Orland project of the U. S. Reclamation Service, at a cost of

39 cts. per square yard, have effected a saving of 60 per cent in maintenance costs over earth sections and have reduced seepage losses to less than one-third of those in clay. Data on construction and cost are also given.

Report on cleaning canals with modified disk harrows, Minidoka irrigation project, Idaho, H. L. CRAWFORD (*Reclam. Rec. [U. S.], 13 (1922), No. 2, pp. 22-24*).—In experiments on the cleaning of irrigation canals of moss or so-called seaweed, it was found that submarine saws and scythes while effective were not feasible. A modified disk harrow was found to not only remove moss but to go down into the silt on the canal bottom and loosen a great part of the moss bulbs. It was found that only two cleanings were necessary for the season instead of one every two or three weeks with saws or scythes. A crew could clean on an average 1 mile per day of main canal and 1.75 miles of lateral.

The essential difference between the modified disk and the ordinary farm disk harrow is in the steel frame which connects the disks to the drawbar. It consists of two $\frac{3}{4}$ by $1\frac{1}{2}$ in. steel bars, bent to form a semicircle 3 ft. in diameter and placed one above the other at a distance of about 4 in. and rigidly bolted together at six points. A horizontal cross brace, consisting of a $1\frac{1}{4}$ by 3 by $\frac{1}{4}$ in. angle, joins the ends of the curved bars. A heavy tongue about 8 ft. long and shod with steel on both sides is fastened at one end to the center of the angle-iron cross brace. This tongue works between the curved bars and can be swung to several angles and bolted rigidly to the semicircular part of the frame. A heavy steel ring is fastened at the other end of the tongue, to which two $\frac{3}{8}$ -in. crucible steel cables 25 ft. in length are attached for lateral work, or two 50-ft. cables on the main canals. The disk is operated by a team on each bank hitched to one of these cables. Twenty-inch disks are used on $\frac{1}{2}$ -in. steel shafts.

Comments by B. Dibble are included.

Land drainage, W. L. POWERS and T. A. H. TEETER (*New York: John Wiley & Sons, Inc., 1922, pp. 1X+270, figs. 106*).—This book is one of the Wiley Agricultural Engineering Series, edited by J. B. Davidson, and deals with the subject of drainage primarily from the agricultural viewpoint. The subject is developed largely as a matter of applied soil physics. It contains chapters on development, importance, and future of drainage; benefits of drainage; the relation of soils to drainage; forms of soil water; types of drains and their location; materials for covered drains; depths and frequency for tiles; measurement of drainage water; size and grade for tiles; construction of underdrains; cost and profit of tile drainage; development of wet lands; drainage districts and drainage laws; assessment of drainage benefits and costs; large tiles v. open ditches; design, construction, and maintenance of open ditches; estimate of costs of drainage systems; the drainage of tidal and overflowed marsh lands; the drainage of irrigated lands; miscellaneous drainage problems; and drainage surveying and practice.

The determination of distance between drains, E. KRÜGER (*Internatl. Mitt. Bodenkn., 11 (1921), No. 3-4, pp. 105-110*).—Studies on the relative permeabilities of soils as influenced by their content of particles of less than 0.01 mm. and of particles between 0.01 and 0.05 mm. in diameter showed that the permeability increased as the content in coarser particles increased. This is considered to be a logical basis for the establishment of accurate methods for determining the proper distance between drains, the results being taken to indicate that the distance may be greater as the content of coarse matter increases. No exact relation is derived.

Report of an engineering investigation on the maintenance of drains on Reclamation Service projects, C. E. LOUNSBERRY (*Reclam. Rec., [U. S.], 13*

(1922), No. 1, pp. 1-4).—Data on unit costs of maintenance of open drains for the period from 1917 to 1921, inclusive, on nine U. S. Reclamation Service projects, having an average total length of drains of 351.13 miles, are tabulated. The average unit costs per mile year were for patrolling \$6.10, clearing of weeds and debris, \$17.06, clearing of silt and caved material \$16.32, repairs to structures \$11.63, minor expenses \$3.90, and overhead \$14.76.

Data for a similar period on unit costs of maintenance of closed drains on six projects, having an average total length of drains of 158.53 miles, showed that the average unit costs per mile year were for patrolling 53 cts., clearing tile and trap boxes \$14.72, repairs to tile and trap boxes \$31.00, minor expense and plant and equipment charges \$2.54, replacement of drains \$2.15, and hydrometry 1 ct.

Drainage in the Mesilla Valley of New Mexico, D. W. BLOODGOOD (*New Mexico Sta. Bul.* 129 (1921), pp. 37, figs. 21).—Studies of ground water level fluctuations in the Mesilla Valley of New Mexico and of the results of drainage on such soils, made in cooperation with the U. S. Department of Agriculture, are reported.

The valley has an area of about 90,000 acres of bottom land, and the soils vary from gravel to clay adobe. The water table fluctuations were studied by means of 86 test wells driven to an average depth of 15 ft.

These studies show that there has been a gradual rise in the level of the water table since 1905. In the six years between 1911 and 1917, there was a total rise of about 5.5 ft. Prior to the completion of the Elephant Butte Dam in 1916, the irrigation water carried a large quantity of silt which tended to fill the pores and cracks in the soil when the water was run over it, while since 1916 the water has been almost clear, due to the silt settling out of the water while in the reservoir, and much more water is needed during irrigation because of the loss by deep percolation.

It is concluded that the chief cause of the rapid rise of the water table in the valley was the rapid percolation of the practically clear water during irrigation. Drainage was found to be quite effective. Drainage ditches lowered the water table an average of from 5 to 6 ft., and the benefit was found to extend a mile or more from the ditch.

It was also found that alkali can usually be washed out of the soil by flooding where the water table is 5 ft. or more from the surface. A large percentage of the drainage water was found to be unsuitable for irrigation owing to its high content of soluble salts. On account of the sandy nature of the subsoil open drains have been used which so far have had an initial cost of \$7,745 per mile.

A brief discussion of the reclamation of alkali lands, by A. A. Laferriere, is also included.

Pocket companion (*Pittsburgh: Carnegie Steel Co.* 1921, 22. ed., pp. 414, figs. 169).—This is the twenty-second edition of this well-known structural steel handbook. It has been placed abreast of the most approved methods in structural design, and, with previous editions, is considered to record the stages of development in the manufacture and fabrication of structural steel.

Wood conservation and impregnation, F. MOLL (*Holzkonservierung und Imprägnierung. Berlin: Holzmarkt*, [1920], pp. [2]+99, figs. 42).—This publication deals with the preservation of wood as a structural material, and contains chapters on the properties, uses, and enemies of wood; protective measures other than treatment; treatment with organic substances; development of impregnation with tar and other compounds under pressure; impregnation with salts; wood coloring; and structural uses of impregnated wood. A bibliography is included.

Selection of aggregate for concrete roads, D. A. ARREAMS (*Concrete [Detroit]*, 20 (1922), No. 4, pp. 159-163).—In a contribution from the Lewis Institute, both technical and practical information is given on the selection of aggregate for use in concrete roads.

Alcohol a combustion fuel, E. C. FREELAND and W. G. HARRY (*Sugar [New York]*, 23 (1921), Nos. 8, pp. 432-434; 9, pp. 474-476; 10, pp. 536-538).—This report summarizes considerable data and information from various sources on the use of alcohol as a combustion fuel in internal-combustion engines, as well as results of tests of different alcohol mixtures in tractors and automobiles. In one set of tests with tractors, in which a mixture consisting of 100 gal. of alcohol, 8 gal. of petrol, and 0.5 gal. of pyridin was tested, no difficulty was experienced in starting the cold motors and their full power was developed. The consumption of the mixture averaged 50 per cent more than when petrol was used.

Palm oil motors and burners and their actual use in colonial agriculture, G. L'ERPÊTE (*Ann. Gembloux*, 27 (1921), No. 12, pp. 385-397, figs. 2).—Experience in the Belgian Kongo on the operation of an internal-combustion engine and an oil burner using palm oil as fuel is described.

Tests with a 10 h. p. internal-combustion engine using an incandescent bulb for ignition indicated a minimum of carbonization and nearly perfect combustion. The palm oil was found to remain liquid in all parts of the fuel line, and a regular speed was maintained with a constant fuel charge. The consumption of lubricating oil was apparently exceptionally low.

Test of a tractor operating on producer gas, R. GREILSAMMER (*Compt. Rend. Acad. Agr. France*, 7 (1921), No. 32, pp. 696-701).—A comparison of low-grade gas, produced by the combustion of charcoal, with gasoline as a tractor motor fuel in actual plowing is briefly reported, showing that the gasoline cost on this type of work in a 35 h. p. 4-cylinder motor was from six to seven times greater than the cost of the producer gas used. The gas produced about 25 per cent less power per unit than gasoline. More lubricating oil was required with the gas, but the oil retained its lubricating properties a longer time. Valves, valve seats, and spark plugs were in a better condition after using gas than after using gasoline. It is concluded that at the present prices of charcoal an economy of about 85 per cent can be effected by the use of producer gas for tractor motors on plowing.

Nebraska tractor tests (*Chicago: Farm Impl. News*, 1921, pp. 76, figs. 19).—The data from the tests made during 1920 at the University of Nebraska on 65 tractors in accordance with the requirements of the Nebraska tractor testing law are presented, together with an analysis thereof made by E. A. White.

Chilton tractor index (*Chilton Tractor Index*, 5 (1922), No. 1, pp. 344).—This number of this index contains the usual data and information regarding tractors, tractor parts, tractor manufacturers, and related matters.

The efficient use of animal power, W. DINSMORE (*Agr. Engin.*, 3 (1922), No. 2, pp. 23-26, figs. 3).—The author summarizes his observations and experience in the multiple hitching of horses in an effort to increase the efficiency of the use of animal power. Diagrammatic illustrations showing effective hitches are included.

Work utilizing teams, M. RINGELMANN (*Jour. Agr. Prat.*, n. ser., 35 (1921), No. 49, pp. 472, 473, fig. 1).—The results of a study and analyses of the utilization of teams during a year on a French farm averaging 259.4 hectares (about 641 acres) are briefly reported.

The work stock consisted of 17 horses and 18 oxen. During the year it was found that there were 7,591.25 animal days of team work out of a possible total of 10,770.5 animal days, or a percentage utilization of 70.4. The highest utiliza-

tion of animal days of team work was in March (87 per cent) and October (82 per cent), and the lowest in June and July. It is noted that 167 hectares were in clover, oats, beets, potatoes, carrots, and turnips.

Removing dockage from wheat at the thresher, R. H. BLACK (*Agr. Engin.*, 3 (1912), No. 2, pp. 19-21, figs. 3).—In a contribution from the U. S. Department of Agriculture, studies on devices for the removal of dockage from wheat at the thresher are reported.

An experimental aspirator operated while threshing oats, rye, and a mixture of oats and wheat with a 20 by 34 in. separator removed between one-third and one-half of the dockage from each of the grains with a slight loss of small and shriveled kernels of grain. Since the wild oats seemed to be the cause of the failure of most of the recleaners already built, it was decided to build a machine using the basic principles of disks provided with small pockets and moving vertically through the grain. This machine, when installed on a 22-in. separator threshing grain containing percentages of dockage ranging from 1 to 38 per cent, gave an efficiency such that wheat which contained up to 20 per cent of dockage contained after cleaning no assessable dockage. It was found impossible to feed the grain into the thresher cylinder fast enough either to clog the cleaner or to lower the quality of work which it performed.

Farm buildings, W. A. FOSTER and D. G. CARTER (*New York: John Wiley & Sons, Inc.*, 1922, pp. XI+377, pl. 1, figs. 330).—This book deals with the location, planning, construction, and repair of farm buildings. Considerable of the material presented has been collected from the State agricultural experiment stations. Chapters are included on the dairy barn; the horse barn; beef cattle and sheep barns; general purpose barns; barn equipment; essentials of barns; classification of barns; barn construction; barn framing; barn ventilation; hog houses; hog house sanitation; poultry houses; grain storage buildings; silos; implement and machine shelters; ice houses; minor buildings; home-built farm equipment; development of the farmhouse; planning the farmhouse; farmhouse construction; the tenant house; farm home equipment; farmstead planning; wood as a building material; cement and concrete; brick and hollow building tile; mechanics of farm buildings; building codes and fire prevention; contract and specifications; cost estimating; plan drawing; rafter framing and cutting; weights, measures, and formulas; and reference table for farm building design.

Floors for farm buildings, C. BERTELE (*Nachr. Dcut. Landw. Gesell. Österr.*, n. ser., 5 (1921), No. 32-33, pp. 326, 327).—The relative merits of 13 different types of floors and floor materials for farm buildings are discussed. Clinkers, clinker concrete, and sand-cement concrete are considered to be among the better materials for stock buildings.

The Ohio colony brooder house (*Ohio Agr. Col. Ext. Bul.*, 17 (1921-22), No. 5, pp. 8, figs. 6).—Detailed drawings of a portable house large enough to brood 500 chickens at one time are presented and discussed.

Importance of good and wholesome water for the farm, C. ZWAGERMAN and L. W. DE WAARDT (*De Beteekenis van Goed en Voldoende Water voor het Boerenbedrijf. Goes: N. V. Waterleid. Mantsch. Zuid-Bereland*, pp. 55, figs. 32).—This publication deals with water supplies for farms in the Netherlands, with particular reference to their sanitary aspects when used for drinking by man or animals, for cleaning purposes, and in butter and cheese making. Methods of storage and distribution of drinking water in dwellings, in stalls, and in pastures are discussed.

Investigations on the action of slow sand filtration, W. HILGERS and L. LAUTER (*Gandhts. Ingen.*, 44 (1921), No. 31, pp. 331-388).—Ten different series of studies on the factors influencing the purifying action of slow sand filters

on water are reported. The influence of adding potassium cyanid on the protozoan content of filters was specially studied. The temporary suppression of the filter action by potassium cyanid was not found to be due to its toxic action on the protozoa, but rather to the destruction of the film of colloidal organic matter on the surface of the filter.

It was found possible to form an artificial film such that a filtering action for bacteria took place, but such filters do not have normal action. It is concluded that the action of a slow sand filter depends primarily on the gelatinous organic matter which is separated mechanically from the filtered water, but that filtration as a whole depends upon a series of factors, including depth and density of sand layers and organic matter content of the water, the activity which involves colloidal phenomena.

Sanitation and sewage disposal for farmsteads and country estates, W. P. GERHARD (*New York: Author* [1921], pp. 12).—This is a brief general discussion of the subject.

RURAL ECONOMICS AND SOCIOLOGY.

The study of agricultural economics, C. S. ORWIN (*Brit. Assoc. Adv. Sci. Rpt.*, 89 (1921), pp. 1-12).—Certain economic problems associated with farming are outlined as requiring further investigation. Among these are the proper application of capital per unit of land, methods and costs of distribution of agricultural products, labor output, and labor's share of the net returns of farming.

In the latter connection an investigation, made at Oxford before the war, of the distribution of net returns of agriculture between landlord, farmer, and labor is noted. In this net returns were calculated from net output ascertained by a method of deducting the cost of materials from the value of the output, the difference constituting the fund from which wages, salaries, rent, royalties, rates, taxes, depreciation, advertisement and sales expenses, and all other charges, as well as profits, must be defrayed. In applying this measure of net output to the agricultural industry, the farmer's capital is valued at the beginning of the year, and to this figure are added all live and dead stock bought during the year, foods, manures, and other charges. The total is deducted from the sales during the year added to the valuation of the farmer's capital at the end of the year. Only in the case of the workers is their share net income.

A certain inquiry conducted in 1909 is said to have indicated that about 30 per cent of the rent received by the landlord is expended for repairs, insurance, management, and similar expenses.

An investigation of six farms scattered over the country and differing radically as to systems of management, soil, locality, and other features is mentioned. It was found that the proportions going to each of the three interests varied little, about 20 per cent accruing to the landlord, 40 per cent to the farmer, and 40 per cent to labor.

Studies of labor management and of methods of farm bookkeeping are also noted.

Changes in productivity and returns of agriculture in recent years on peasant holdings and large estates in Thuringia, G. SIEBER (*Die Veränderungen in der Produktivität und Rentabilität der Landwirtschaft während der letzten Jahre, Erläutert an Bauern- und Rittergütern Thüringens. Berlin: Emil Ebering, 1919, pp. 149*).—Two peasant farms, one small and one of medium size, and three large estates were made the subjects of detailed study through the years 1913 to 1917, inclusive. The war and government control of feeding

stuffs are shown to have affected seriously the live-stock industry on both types of holdings. The peasant farms are said to have suffered greater reductions in the size of herd and in milk and butter-fat production, largely owing to the fact that they were more dependent upon purchased feeding stuffs than were the larger farms.

Recent cost of production calculations for one hundredweight each of wheat, rye, oats, and potatoes on a Westphalian estate, J. KÖHNE (*Deut. Landw. Presse*, 48 (1921), Nos. 12, pp. 79, 80; 13, pp. 89, 90; 14, p. 96).—The principal expenses of crop production are classified as interest on land and buildings, cost of fertilizers, seed, horse labor, man labor, overhead, expenses of hail and fire insurance, taxes and indebtedness, and interest on working capital. Close estimates of expenditures in each of these groups are submitted in this paper from a convent estate of 285 hectares (704 acres) in Westphalia for the year 1919. In the summary it appears that the total cost of production of one hundredweight (50 kg.) of wheat, rye, oats, and potatoes was, respectively, 42.53, 46.77, 42.53, and 7.85 marks.

Farm management surveys in Blackhawk, Grundy, and Tama Counties, Iowa, H. B. MUNGER (*Iowa Sta. Bul.* 198 (1921), pp. 353–368, 369a–375b, 376).—The average labor income of 965 farmers in adjacent parts of these counties in 1913 was \$306, and the return on investment 4.1 per cent. A second survey conducted in cooperation with the Office of Farm Management and Farm Economics, U. S. D. A., was made on 210 farms in the same area for the year beginning March 1, 1918. The returns from this survey indicate that the average labor income was \$1,382 and the return on investment 6.3 per cent. Thirty-five per cent of the farmers in 1913 and 19.2 per cent in 1918 had minus labor incomes; 4.3 per cent in 1913 and 33.6 per cent in 1918 had labor incomes of \$2,000 and over. The average value of land was \$197 per acre in 1913, \$254 in 1918, and \$359 in August, 1919. It is said that farmers with over 20 per cent of their lands in pasture would increase their profits by decreasing the pasture acreage and substituting corn, oats, and clover. Farms having a relatively large number of hogs and few cattle were found to be more profitable. Buying feeder cattle was more profitable than maintaining a breeding herd of beef cows and raising young stock. Dairy farms had nearly twice as large labor incomes as the average of all farms studied in 1913. Farmers who receive most of their receipts from crops realized larger labor incomes in 1918.

The agrarian Indian communities of Highland Bolivia, G. McC. McBRIDE (*New York: Amer. Geogr. Soc.*, 1921, pp. [2]+27, pls. 2, figs. 2).—This paper describes the aboriginal system of land tenure in the Highland Provinces of Bolivia, where Indian communal holdings have existed since ancient times. The distribution of the surviving communities in the several departments is indicated, and statistics are given representing approximately the Indian population and the extent of its holdings. Considerable unrest and apprehension is noted, due to encroachment by white neighbors.

Agricultural credit societies, W. G. FREEMAN (*Trinidad and Tobago Agr. Credit Soc. Rpt. 1916–1921*, pp. 16).—Report is made on the working of agricultural credit societies in Trinidad and Tobago, 1916–1921.

A progressive tax on bare land values, J. R. COMMONS (*Polit. Sci. Quart.*, 37 (1922), No. 1, pp. 41–68).—This paper discusses profit as a constructive factor, as an incentive to the creation of wealth, and as a basis for taxation as opposed to ability to pay. A maxim of taxation is put forward to the effect that taxes should be apportioned directly according to ability to pay and inversely to the extent to which the employment of facilities and resources increases the common wealth. Such apportionment is said to be an attempt

to guide the practice of obtaining revenue by proportioning inducements to attain profits.

The Grimstad and Nolan bills recently considered, the one in the Wisconsin Legislature, the other in Congress, are compared in so far as they have to do with the taxation of fertility and improvements on land. Both propose a progressive tax on large land values in single holdings. The Nolan bill does not exempt fertility from its proposed surtax, although it exempts structural improvements. The Grimstad bill exempts both. Both are said to be an application to the general property tax of the two standards, ability to pay and payment inversely to public benefit. It is held that the surtax advocated can not be shifted over to the public.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 1 (1922), Nos. 9, pp. 177-192, figs. 2; 10, pp. 193-216, figs. 9; 11, pp. 217-248, figs. 4; 12, pp. 249-264, figs. 2).—Current weekly reviews of weather conditions, with temperature and precipitation charts, are continued in these numbers. Statistical information as to receipts and prices of important classes of agricultural products, with special articles reviewing the position in the market of particular commodities and local or outstanding market situations, is also given.

In No. 10 is found a statistical summary of the country's foreign trade in agricultural products during the calendar year 1921. It is indicated that the sum of 32 of the principal agricultural exports in 1921 shows an increase of 27 per cent in quantity over 1920, while the declared value of these same commodities was 39 per cent less than the 1920 export values, reflecting the decline in prices received for farm products during the past year. Several tables are presented, making comparisons of imports and exports in 1920 and 1921, with the average for the period 1910-1914.

A section of No. 11 is devoted to crop reports (pp. 233-245), in which appear the United States crop summary for March; statistics relating to farm stocks of grain March 1, 1922, and shipments out of the country where grown; the usual estimated farm value of important products; averages of prices received by producers of the United States; and numerous other tabulations.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul.*, 9 (1922), No. 49, pp. 8).—This continues the usual classified partial list of products which farmers have for sale, together with a note on cooperative storage and marketing of sweet potatoes.

Annual report of the Winnipeg Grain Exchange, 1921 (*Winnipeg Grain Exch. Ann. Rpt.*, 13 (1921), pp. 173).—This report gives amendments to trading room regulations, contract grades and discounts fixed by the council for the year ending September 30, 1922, and statistics of prices of grain on the Winnipeg Grain Exchange, 1920 and 1921.

Rural reconstruction in Ireland, L. SMITH-GORDON and L. C. STAPLES (*London. P. S. King & Son, Ltd.*, 1917, pp. XIII+279).—This volume contains a record of cooperative organization, describing economic and social conditions of agriculture in Ireland and land legislation; the early history, principles, and ideals of the Irish cooperative movement; the form, functions, and finances of the Irish Agricultural Organization Society; cooperative creameries; agricultural and credit societies; home industries; the Department of Agriculture and Technical Instruction; industrial cooperation and its relation to the agricultural movement; and other phases of the question.

Agriculture in eastern Europe, E. D. DURAND (*Quart. Jour. Econ.*, 36 (1922), pp. 169-196).—It is pointed out that even under pre-war conditions most of eastern Europe, especially Russian Poland, was very densely populated,

and that the per capita agricultural production was extremely low. Live-stock raising has always been relatively unimportant. It is asserted that in pre-war years the grain exported was a small proportion of the total production.

Effects of the war and government control of food prices are shown to have been particularly distressing on account of the inefficiency of agriculture in this region. Big estates suffered relatively more than peasant farms, although cultivation by the large landholders is said to have been somewhat superior to peasant farming. Much parcelation of big estates and regrouping of peasant holdings has been carried out, but political and economic conditions are still such as to retard agrarian reform.

The two most striking defects in peasant agriculture are inadequate plowing and unsatisfactory crop rotations, with the practice of fallowing a large proportion of the land each year.

Cooperative wine cellars in Italy, F. J. CUENDE (*Prog. Agr. y Pecuario*, 27 (1921), No. 1204, pp. 413-416).—As a result of a crisis in the wine-making industry in Italy in 1903-1904, the law of June 11, 1904, was passed for the relief of the industry. A certain amount of credit was granted to small growers, and State support was given to the federated cooperative wine cellars. This article sets forth methods of classifying the product received, prepayment to producers, and other characteristics of this form of cooperation.

Cooperation for farmers, C. C. CRANE (*Agr. Gaz. N. S. Wales*, 32 (1921), Nos. 8, pp. 553-559; 9, pp. 639-643).—In making suggestions for farmers' cooperative undertakings, the author has set forth first certain principles on which Rochdale societies are founded and some of the advantages of cooperative stores. Two trading societies in New South Wales, one a bulk-buying concern operating without registration and without the formation of a company, the other a registered cooperative society, are described as typical of successful farmers' concerns. A detailed plan of procedure for organizing a cooperative society is presented.

Report on the working of the cooperative societies in the Central Provinces and Berar for the year 1919-20, A. L. HOYLE (*Cent. Provs. and Berar [India], Coop. Soc's. Rpt., 1919-20*, pp. [2]+16+6+21).—This gives a general progress report of rural credit societies, central and provincial banks, and other cooperative societies.

The cooperative societies of Japan (*Tokyo: Dept. Agr. and Com., Bur. Agr., 1921*, pp. [1]+15+[2]+10).—This report deals with the development of the cooperative movement in Japan since about 1892. Comparative tables are given in appendixes. The societies for cooperative warehousing of agricultural products and purchase of fertilizers are said to be important.

[Wealth of the United States in farms, farm implements, and live stock], W. R. INGALLS (In *Wealth and Income of the American People*. York, Pa.: G. H. Mertin Co., 1922, pp. 82-86, 94-96).—Census and other official statistics are briefly reviewed.

Agricultural statistics for Massachusetts and New England, compiled by S. R. DOW (*Mass. Dept. Agr., Dept. Bul. 41* (1921), pp. 86).—Numerous tables have been compiled, principally from the United States census for 1920 and from estimates for 1920 and 1921 by the U. S. D. A. Bureau of Markets and Crop Estimates.

Agricultural economics and statistics, E. LAHITTE (*Min. Agr. Argentina, Mem. Cong. Nac., 1920*, pp. 1-15).—These pages present a review of the work of this section of the Ministry of Agriculture for Argentina in 1920.

[**Agricultural statistics for the Netherlands**] (*Jaarc. Konink. Nederlanden, Rijk Europa, 1920, pp. 190-199*).—These pages continue annual statistical reports previously noted (E. S. R., 45, p. 397).

[**Agricultural statistics for the Dutch Colonies, 1919**] (*Jaarc. Konink. Nederlanden, Koloniën, 1919, pp. 66-78, 157, 158*).—These pages continue statistical reports previously noted (E. S. R., 46, p. 93).

AGRICULTURAL EDUCATION.

A comparative study of achievement in country and town schools, N. Frost (*Columbia Univ., Teachers Col. Contrib. Ed., No. 111 (1921), pp. 70, fig. 1*).—This study was undertaken with the specific objects of (1) showing that the difference in performance in school subjects of children of different ages can be obtained, (2) that this difference is a measure of school efficiency which may be used to measure schools or school systems, (3) applying this to a certain system of country schools, and (4) comparing the results in this country school system with those in certain city school systems.

Three tests, the Trabue Completion-test Language Scale B, the Courtis Standard Research Tests in Arithmetic Series B, and Thorndike Silent Reading Scale Alpha 2, were applied in the country schools of Madison County, Ky., where there are 68 public white schools, 6 of which have 3 or more teachers and a term of 9 months, the rest having only 1 or 2 teachers and a 6-month school year. A county supervisor of schools is employed to assist the county superintendent.

The results in Madison County were compared with those obtained in Louisville, Ky., and other cities in various sections of the United States. It is stated that the children of the Madison County 6-month schools showed less ability along every line tested than the children of the same age in other schools and that they are learning more slowly, except that the children in one city are improving as slowly in language. The Madison County 9-month schools compare more favorably.

In the appendix there is given a list of school surveys, and some educational literature is noted.

New York State rural school survey, G. A. Works (*Ed. Rev., 63 (1922), Nos. 3, pp. 247-256; 4, pp. 277-287; 5, pp. 412-423, pl. 1*).—In these pages a report is made by the so-called "Committee of Twenty-one" on a survey of rural schools in New York, studying particularly the school administration, school support, and the qualifications of rural teachers.

School administration was found to be of three types, two under district administration, the common school and the union free school, and a third controlled by what is known as the supervisory district.

One supervisory district in each of three counties was studied intensively. In addition a random selection was made of 1,070 common-school districts scattered throughout the State. A marked variation in tax rate was discovered, said to be due to a variation in real wealth of the school districts and in the willingness of different districts to support their schools. Thus it was found that in Delaware County there were four districts with a true valuation between \$10,000 and \$20,000 and one with a valuation between \$340,000 and \$350,000. In Monroe County the lowest valuation was found to be between \$100,000 and \$110,000, and there were two districts with valuations of over \$900,000. In Tompkins County the range was from three districts with valuations between \$20,000 and \$30,000 and one with a true valuation between \$250,000 and \$260,000.

It is noted that the median true valuation per teacher was \$108,070 in the common-school districts, \$107,727 in the union free-school districts, and \$182,857

in the cities of the State and those villages having superintendents—that is, in places of over 4,500 population.

The following figures for median per capita cost of furnishing school facilities are given: Cities \$61, villages \$62.50, union free school districts \$62.50, and common-school districts \$64.76.

Findings with regard to age and experience, academic and professional preparation, and the home and social experience of the teachers in one- and two-teacher schools and village schools are tabulated. The data submitted indicate that important changes are needed in the administration, financing, and teacher preparation for the rural schools of this State.

The recommendations of the committee are set forth.

The rural school lunch to-day, L. MILAM (*Jour. Home Econ.*, 14 (1922), No. 3, pp. 128-131).—From data collected in March and April, 1921, hot lunch work in the rural schools of the United States was found to be carried on as follows: Supervision is provided by separate specialists who direct the work; by the department of education, alone or in cooperation with the department of public health; by the extension service; and by the extension service in cooperation with the department of education or with the vocational home economics department.

Data as to type of supervision, percentage of schools serving hot lunches, and number of public-health nurses are tabulated by States.

Eight States have hot lunch clubs, 17 use graphic posters, and 21 issue bulletins or other material through public agencies.

Education for farmers, H. HOPPE (*Fühling's Landw. Ztg.*, 70 (1921), No. 17-18, pp. 321-335).—In this paper suggestions are made for a system of education for farmers, embracing first a period of about one year after the student has finished his secondary education in arts and science, to be spent gaining practical experience under the direct supervision of a specially qualified farmer; second, a period to be given to general cultural and economic studies, including legal and business aspects of farm marketing; and, third, another period of practical training where the agricultural licensee would himself have supervision of both intensive and extensive agricultural enterprises. It is suggested that a third year be spent in special marketing or business enterprises. This system would be under the direction of German agricultural councils and supported by the agricultural industry itself.

Botany, developmental and descriptive, W. MANSFIELD (*Philadelphia: Lea & Febiger*, 1922, pp. VII+17-232, figs. 135).—In part 1 of this textbook, special attention is given to the development and relationship of plants, to the modifications of the reproductive process and organs, and to the development of new tissue or special modifications of old tissue in each succeeding higher group. Part 2 contains the facts considered necessary for a complete understanding of the study of roots, stems, buds, leaves, flowers, fruits, and seeds. The illustrations consist largely of photographs.

The teaching of soil bacteriology, P. E. BROWN (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 323-329).—A separate and distinct course in soil bacteriology is said to have a place in the curriculum of every agricultural college, and suggestions are made as to prerequisites for such courses, outlines of lectures, and laboratory exercises.

NOTES.

Alabama College and Station.—Dr. Alfred H. W. Povah, associate professor of plant pathology and associate plant pathologist, has been appointed assistant professor of botany at Northwestern University.

California University.—A board of five members has been designated by the governor to locate a site and prepare plans for a school or college of agriculture in southern California. This board consists of H. A. Jastro, chairman, Senator S. C. Evans, Mark Grimes, G. H. Hecke, and Dean T. F. Hunt.

This board is entirely distinct from the commission of seven also appointed by the governor to report upon a system of agricultural teaching and investigation in the State, as previously noted (E. S. R., 46, p. 599). The commission comprises A. C. Hardison, chairman, W. S. Gullford, Dr. Elwood Mead, J. James Hollister, S. W. Baker, S. G. Mortland, and R. G. Sproul, comptroller of the university. The commission has recently returned from a comprehensive tour of the country, during which many institutions were visited.

Dr. J. C. Whitten, head of the division of pomology since 1919, died on June 5 at Washington, D. C., where he had come to attend a conference of the Federal Horticultural Board. Dr. Whitten was born in Maine in 1886 and educated at the South Dakota College (B. S. 1892, M. S. 1899), Cornell University, and the University of Halle (Ph. D. 1902), and previous to going to California had served in various capacities at the South Dakota College, the Missouri Botanical Garden, and the Missouri University and Station. His long service at the last-named institution from 1895 to 1918 was specially noteworthy and included numerous research projects of a high order, such as the relation of color to temperature and hardness of cultivated plants, breeding for hardness in the peach and for late blossoming in the apple, fruit bud development in various orchard species, bud variation in the apple and strawberry, and pruning, transplanting, and nutritional studies with several horticultural plants.

Dr. Whitten had also rendered most effective service as a teacher, helping to train an unusual number of well-known workers in horticultural fields. He was a member of many organizations, including the American Association for the Advancement of Science, the American Society for Horticultural Science, the Society for the Promotion of Agricultural Science, the American Pomological Society, and others. He was the author of a number of books and of several hundred papers in station publications, horticultural magazines, etc.

Kansas College and Station.—The college and station are cooperating informally with the recently organized Southwestern Wheat Improvement Association, which has its headquarters in Kansas City, in a long-time campaign to improve the quality of winter wheat produced in Kansas and adjacent States. The program agreed upon seeks two principal objects: (1) A change in wheat buying practices, especially at country points, so that the prices paid to individual wheat growers will more nearly reflect quality differences than do present practices; and (2) improvement in methods of production to eliminate or minimize the factors which now depress quality. It is expected that the campaign will have the support of all agricultural and commercial interests of the southwestern winter wheat region and that it will be chiefly educational.

Construction of the new addition to the agricultural building, which is to cost \$275,000, was started June 1.

The degree of doctor of science was conferred at the recent commencement on C. V. Piper and W. T. Swingle of the Bureau of Plant Industry of the U. S. Department of Agriculture.

Kentucky Station.—C. G. Fuss, assistant chemist in the public service laboratories, resigned May 31. Harry Allen, assistant chemist in the fertilizer department, has been appointed chemist, and Lelah Gault assistant chemist.

Maine University.—Among those receiving the degree of doctor of science at the recent commencement was L. S. Merrill, dean of the college of agriculture and director of the extension service.

Massachusetts College and Station.—The vacancy caused by the resignation last fall of Dr. W. S. Regan as assistant professor of entomology has been filled by the appointment, effective September 1, of Dr. Charles P. Alexander, systematic entomologist in the State Natural History Survey of Illinois.

Dr. Hubert D. Goodale, research professor of poultry husbandry and specialist in problems of heredity in poultry, resigned June 1 on account of ill health. Miss Ethel M. Bradley, analyst in control work, resigned July 15.

Michigan College and Station.—A new substation of 40 acres has recently been established at Mancelona in Antrim County. Potato culture and soil fertility are to be the major projects at this substation.

A building and equipment for hogs is to be constructed on the college farm. Another building 90 by 40 feet will soon be available for increased work in beef cattle investigations.

Recent appointments include O. B. Price, assistant in soils in the Missouri University and Station, as research assistant in soils, and H. M. Wells of the Ohio State University as assistant in horticulture.

Mississippi Station.—Earle Brintbal has resumed his duties as dairy husbandman after a year's leave of absence. Rowland Cowart has been appointed assistant agronomist beginning July 1.

Missouri University and Station.—V. R. Gardner, chairman of the department of horticulture, has resigned effective September 1 to accept a similar position with the Michigan College, and will be succeeded by T. J. Talbert, a graduate of the university and now superintendent of institutes and extension schools at the Kansas College.

Cornell University.—A pomology storehouse and cold storage plant is being erected in the pomology orchards at an estimated cost of about \$30,000. The building will provide a modern packing plant, a cold storage system with a capacity of 2,000 bbls., and three rooms for experimental work.

New York State Station.—Walter F. Norton has been appointed assistant chemist beginning July 1.

Pennsylvania College and Station.—A meeting of about 150 farmers of the State to consider the needs of the institution along research lines was held at the college May 25 and 26. This group of farmers investigated the situation very thoroughly, appointing subcommittees to bring in recommendations as to the needs in the various lines of subject matter, and before adjournment designated a permanent committee of 12 to endeavor to see that the recommendations are made effective.

Practically all the subcommittees laid emphasis on the need of increased financial support, laboratory and other facilities, and additional personnel. Indorsement was given to the principle of special taxation to insure an adequate and permanent financial policy for the institution. The construction of a new

station building was urged, as was also the appointment of a vice director of research.

State support of the Institute of Animal Nutrition was advocated, not only to maintain present investigations but for their extension to include work with sheep and swine. Other recommendations looked toward the provision of improved library facilities, the purchase of a dairy farm and herd, the rapid extension of the soil survey and the establishment of soil test farms on each important soil formation of the State, a new horticultural building and modern greenhouses, an elaborate poultry husbandry building and plant, additional buildings for animal husbandry, botany, plant pathology, and entomology, enlargement of the work in farm engineering, the provision of a distinct department of beekeeping, and the establishment of a department of farm economics, marketing, and rural sociology.

The resignations are noted of Carl G. Vinson, professor of pomology extension, effective May 1; H. E. Thomas, assistant professor of plant pathology, effective June 30; H. K. Anderson, instructor in agricultural education, effective April 1; P. J. Haler, assistant in forestry, effective July 15; B. B. Mason, assistant in rural organization extension, effective June 30; and A. J. Souba, research fellow in poultry husbandry, effective August 15. Recent appointments include Paul Thayer as professor of pomology extension, beginning July 15; J. M. McKee, associate professor of rural economics extension, beginning July 1; L. M. Lindemuth, assistant in forestry, beginning June 15; Monroe J. Armes, assistant in agricultural extension, beginning June 15; and C. J. Irvin, assistant in experimental agronomy, beginning July 1.

Porto Rico Station.—D. W. May, agronomist in charge, is spending the summer in Europe in a study of numerous matters of interest to Porto Rico. Among these are methods of soil treatment, including fertilization; the Spanish races of cattle from which the so-called native cattle of Porto Rico have descended, and the methods of handling Guernsey cattle, many of which are being introduced into the island; the causes of the recent appreciable falling off of French importations of Porto-Rican coffee; and the methods of growing and preserving onions and peppers.

South Dakota College and Station.—The LL. D. degree was conferred upon Director J. W. Wilson by the University of South Dakota at its recent commencement.

Texas College.—A course has recently been established in agricultural administration. This course has been designed primarily for students interested in the business and social side of agriculture and of country life rather than in the production or technical side.

Wisconsin University and Station.—Dr. A. G. Johnson, associate professor of plant pathology and associate plant pathologist, has resigned to devote his time entirely to pathological work for the Office of Cereal Investigations of the U. S. Department of Agriculture.

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The relation of research to the public has been a subject much written about, especially since the war. The value and importance of research have been emphasized by many convincing illustrations, and increased encouragement for developments in that line has been freely prophesied. It has appeared that the hold which science has taken on the public mind was in the nature of a wide awakening whose effects would soon be evident and would be felt permanently.

As time has gone by, however, these expectations have not been fully realized, and there has been some evidence that confidence is somewhat on the wane. Latterly, discussion has turned to the popularization of science; and in that connection there has been analysis of the general interest in science, and the attitude of the public toward it and toward ways and means for its advancement. This discussion has not had particular reference to agriculture, and it has not been confined to this country; but as far as it relates to applied science as a whole it is probably reflected in the field of agriculture, a field in which the meager tangible evidence of stimulated interest has been disquieting. In this country progress has scarcely kept pace with the growth of provisions for agriculture in other directions, and the hold of agricultural research on the public has perhaps not materially strengthened. In Great Britain, which was brought during the war to a keen realization of the importance of that industry, the proposed policy for the liberal encouragement and support of agricultural inquiry and teaching has even suffered a considerable reversal, causing much disappointment to those who had looked for an enlargement of opportunity.

The situation with reference to science as a whole is illustrated by a series of articles in *Nature*, calling attention to the falling off of lay interest in the British Association for the Advancement of Science. This is said to be in such sharp contrast with the previous attitude of the public as to be a matter for concern. In that connection, several correspondents have intimated that the loss of interest and confidence on the part of the public might be due to the fact that scientists had lost their fighting spirit and the courage of their convictions. This is hard to believe, but they have undoubtedly suf-

ferred disappointment which may have dampened the ardor of their public effort.

In this country the relation of scientists themselves toward promoting broader publicity and interest in their work has been brought into the discussion, especially in connection with the writings of popular science. The general opinion is ventured by one writer that there is relatively less popular knowledge of science and less interest in its methods and achievements than there was a generation ago, a view in which several other writers have concurred. It is declared that science is relatively losing ground in popular interest and esteem, and that "it is questionable whether the interest of the American people in scientific questions has kept pace with the growing importance of science in human life."

This relative decline in the popular knowledge of science is attributed by several writers to the form in which science is presented. It is held that "what is needed is the presentation of science in a form comprehensible to the educated and thinking man." A newspaper writer who has paid special attention to writing popular accounts of scientific findings cites his long experience in proof of the charge that "the worst writers on scientific subjects are scientific men, for the reason that they do not know how to make their writings interesting"; and adds that "it is manifestly futile to publish uninteresting articles, for no one will read them."

The argument in the discussion thus far seems to be all on one side, for although it has been going on for five or six months no one has come forward to controvert the general trend of opinion as expressed in scientific journals. It is agreed, moreover, that if the contentions are true it is high time for all men of science to consider seriously the matter of science and the public. It is urged as necessary "to understand the public, the point of view of those we desire to reach, the mental background with which the science we present must be harmonized; to understand science and ourselves; to keep in mind what constitutes science; to have a clear idea of what we wish to give the public." No one will question the need for these things in reaching the general public; the catalog is comprehensive, and bearing it in mind will usually be helpful to writers who aim to popularize their work.

The effective presentation to the general reader of the results of investigation is a matter which workers in the field of agriculture have had to consider and to deal with for many years. They have met with a large measure of success. No one will question that they have aroused a tremendous interest in science and its teachings in relation to agriculture, and incidentally in science in a broader sense.

These writings have contributed in no small degree to the growth of general intelligence about that basic industry, and apart from this influence on those engaged in it have given an insight and understanding which have changed the view of the public toward it. It is now seen as involving brain as well as brawn, and as being rooted in scientific principles which the producer must understand and employ. Perhaps few more striking illustrations could be cited of the development of public confidence in science than those which can be drawn from agricultural investigation and experiment during the past quarter century.

Success in reaching the farming people has probably been due in no small degree to the closeness of the workers to their audience; to their understanding of the reader, his business, his experience, and his habits of thought. But as agricultural investigation has become more highly specialized, this contact and acquaintance has not always remained as intimate as formerly; and many investigators at present have not the earlier background of agricultural training or experience. The effect of this may be reflected in their attitude and habit of mind. Not all of them have cultivated the capacity, or do not exercise it, of popularizing their work. To some it apparently makes little appeal, while others are so absorbed in their investigations that they may not realize the importance of this other contact.

Again, as a result of this absorption in the technical aspects of their studies, investigators may get out of the habit of thinking of them in terms of their ultimate bearing. Not infrequently it is difficult to draw out from the more abstract workers succinct examples of the utilitarian aspects of their work. This is partly due to caution, and is often excused on that ground, but actually it may be a reflection of an attitude and habit of thought. The tendency is to concentrate on the thing being done, rather than what it may mean to the popular mind. Partly because of this, those engaged in the simpler lines of experimentation are often able to make a more popular appeal.

No one will question that agricultural investigation has continued to keep close to the ground. It has had very definitely in mind the industry and the people it was seeking to aid. In some cases its attitude may have been too narrowly practical, with the result that it has developed information rather than principles, has stopped with observations and facts instead of disclosing their limitations, their relationships and real significance. The present tendency toward more abstract investigation aims to correct this and lay a broader foundation.

But this growing technical character of investigation should not become a barrier between those who are carrying it on and those in whose ultimate interest it is done. The possibility of such an

occurrence increases rather than diminishes the importance of attention to the popularization of the results of an inquiry whenever the stage is reached where they can be presented and deductions drawn. No matter how abstract and technical an investigation in agriculture may be for the time being, its ultimate purpose is either application or the development of the means of advancing applied science. Hence the investigator can not afford to restrict his audience to scientific readers, or to leave out of his thinking the man on the farm.

To no small extent, however, it may appear to the outsider this is being done. Probably quite as much is now published outside the station literature as in its bulletins and reports. There is less writing by station men for popular consumption than formerly. The annual reports are often of a character that does not invite the attention of the general reader, in some cases being purely administrative records with little in the way of results or explanations of the work and its aims. While many of the bulletins of the regular series are excellent and interpret the results for the reader, others are technical records of experiments written from the research point of view.

Naturally there is very much to be reported which for the time being is suited only to the technical reader. It needs to be recorded for the benefit of advancement in agricultural research. The possible danger lies in inadvertently conveying the impression that the interest lies in investigation for itself instead of for the use that may be made of it. The public deserves, when the time comes, a clear, concise report, which will be instructive as well as informing; will show the meaning of the results as well as give empirical rules; will be scientific in its purport and interpretation, and not alone a record of observations and facts whose relationships are not traced. And it may well be encouraged to look for this through preliminary or tentative reports not too long delayed.

Success in writing for the general public often rests back on the data themselves, the material out of which facts are made. These are not always adequate to a satisfactory presentation. They do not enable the analysis to proceed far enough to explain their meaning and relationships. The method of experimentation followed supplies a large volume of data, but not necessarily such as will give intelligible and constructive information of a scientific character. In some classes of experiments the results can be measured, while in others they are only described. The sources of error in many types of comparatively simple experiments are too great to enable interpretation of the results, and hence they can not be discussed in a confident and straightforward manner.

On the other hand, certain types of work supply only information, facts which are not strictly scientific because their true relations are not determined. They may not be strictly experimental results, because their determination embodies so many factors not under experimental control and whose variations there are no dependable means of estimating. And data which terminate in dollar-and-cent comparisons do not relate to scientific facts although they may be temporarily interesting and informing. They may be given a prominence to which they are not justly entitled; they lack the permanence which attaches to a scientific fact.

The spirit of science is simplicity, to bring order and system out of the complexity of facts and observations, to make the final result so clear that it can be understood and become a part of the general fund of information which the practical man employs in his reasoning and generalization. To that end it is as important to be able to set forth the facts intelligibly as it is to know them.

Popularizing the work of science should not be construed as writing down to the public. It is rather a conscientious effort to state in simple terms something which has been mastered by the writer. The better it is understood, the clearer it can be stated. Such writing carries the writer further in his thinking than does the mere recording of relative results derived from arbitrary variations in treatment. A publication prepared on the latter basis is one of the easiest kinds to write. It requires less digesting of data, and it does not attempt a scientific interpretation of the results with reference to their causes and relationships and limiting effects.

To present the results of investigation or experiment for the general reader requires a mastering of the facts and their meaning, a process of crystallization so that they may be stated with clarity and brevity. It is much less a matter of skill in popular composition than of clear thinking and plain expression. Naturally it involves hard study of the results before the attempt is made to explain them to others, followed by an appreciation of the reader's point of view.

Several of the experiment stations are already giving special attention to popularizing their work and getting it before the public. The press bulletin series of numerous stations is helping to let the public see that it is not being forgotten in a concentration on technical investigation, and is showing the practical bearings of such abstract inquiry. The annual reports of a number of stations have also been directed especially toward these matters, and have been written with specific reference to the general public. They are fine examples of conscious effort in that direction.

The extension force may be a very effective means of publicity, and it often is. This requires, however, some special effort in instruction and in interpreting for them what is being done.

One thing the public needs to be instructed in is the requirements of investigation—the need for doing things in the cautious and laborious way of the investigator, of prosecuting studies which may seem for the time being to be without practical interest. The product of popularization may thus have a double value in showing not only the result but in explaining the manner in which such technical inquiry is directed toward practical ends.

What it is possible to do in presenting technical data based on abstract lines of inquiry was forcibly illustrated by the hearings before the House Agricultural Committee on the Purnell Bill last February. The time-consuming and expensive processes of original research, the steps by which progress is made from point to point, and the practical, every-day value of the results which may follow were set forth in a manner not spectacular but convincing, which commanded closest attention.

A recent attempt of the British Ministry of Agriculture and Fisheries to acquaint the public with the nature, results, and bearings of the agricultural research going on in Great Britain is worthy of mention in this connection. This took the form of a semi-popular pamphlet entitled *Agricultural Research and the Farmer*, described as a record of recent achievement. In it the belief is expressed that in the hard times through which British agriculture is passing, the development of research will prove a powerful agency of restoration.

By way of introduction, it is explained in this interesting account that at least three parties are closely concerned in what agricultural research is doing and proposing, namely, the farmer for whose benefit it is primarily carried on, Parliament which largely provides the funds, and the public which pays the bill and will ultimately receive a full return for the expenditure. But it is urged that the efforts and results of this research are largely unknown to these three interested parties, as the accounts are often published in scientific journals and proceedings to which the farmer or layman does not readily turn, and are set forth in technical language. Accordingly it is felt that "there is a fault in the line of communication between the research worker on the one side and the general public on the other," which this publication attempts to bridge.

Another aim of the pamphlet is to stimulate the interest of the practical agriculturist in research, "and show him that the scientists who are engaged in the research institutions up and down the country are not indulging in a favorite hobby, but are working at problems of fundamental importance to agriculture and exploring new country from which rich provision may in future years be expected." An important suggestion is that "perhaps also the report will serve to indicate some of the difficulties against which research

workers have to contend, and the amount of time and labor which is often required to secure even a small advance in knowledge."

The work has been admirably done. The material gathered from the various institutions is classified and described on a topical basis; and a vast amount of information is presented on the purposes, means, and results, in their proper setting, which cannot fail to be interesting and convincing of its value.

Regarding the propriety of popular writing, it is a mistake to imagine that the attempt to interest and instruct the public in the work being done means stepping out of the special field of the experiment station. Such an attempt is not a departure from the underlying and distinguishing purpose of the station as an agency for gathering facts and making them and their applications known to the public. It means merely an interpretation of the results in practice, a study of the data and facts in their scientific relationship with respect to their meaning to the practical man, with his special environment and background. It involves, of course, carrying investigation to a point where the data can be interpreted in terms of practice as well as contributions to science. Such efforts to make clear and applicable the findings of his investigation are well within the province of the scientific man. They may even be of personal advantage to him, as well as to his institution and the general public.

One of the benefits of attempts to popularize the results of science, if done conscientiously, is reflected in the worker himself. That is why it is not time lost to him or to those in whose interest he is working. It will be reflected in his attitude toward his investigation and in clearer, more critical thinking about it. Manifestly, it calls for studied effort in the case of most workers, and may mean an unwelcome interruption of the course of investigation. But every experiment station owes it to itself to maintain contact with the public through publications from time to time which will explain its work and make its bearings clear. The matter cannot be relegated to the extension service, for the members of that service themselves need to have the results and their meaning clearly crystallized for them.

More general effort in this direction may be necessary to maintain popular interest in the station and to win for it the intelligent support it deserves. Although the assistance of editors and publicity services are quite generally available, it will usually need some attention from the administrative head to keep the matter before the workers and to cultivate in them a favorable attitude and viewpoint.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Technical methods of analysis, edited by R. C. GRIFFIN (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XV+666, figs. 29*).—This book consists of a selection of analytical methods which have been adopted as standard procedures in a large commercial laboratory engaged in technical analysis. The analyses selected include general inorganic, organic, and miscellaneous materials; metals, fuels, paints, and paint materials; oils, fats, waxes, and soaps; wood, paper, and paper-making chemicals; textiles and textile fibers; and foodstuffs.

Public health chemical analysis, R. C. FREDERICK and A. FORSTER (*London: Constable & Co., Ltd; New York: D. Van Nostrand Co., 1920, pp. VIII+305, figs. 60*).—This is a laboratory manual for the analysis of air, water, and sewerage; milk and dairy products; cereal products; sugars; alcoholic beverages; spices and condiments; metallic poisons in foods; and disinfectants.

Proceedings of the thirty-fifth annual convention of the Association of Official Agricultural Chemists, 1919 (*Jour. Assoc. Off. Agr. Chem., 4 (1921), Nos. 3, pp. 319-463, fig. 1; 4, pp. 464-619, pl. 1*).—This is a detailed report of the convention held at Washington, D. C., November 17-19, 1919. A general report of these meetings has been previously noted (*E. S. R., 41, p. 799*).

A method for the cultivation of anaerobes, L. D. BUSHNELL (*Jour. Bact., 7 (1922), No. 2, pp. 277-281, figs. 2*).—The author, at the Kansas Experiment Station, reports success in the use of phosphorus for the removal of oxygen in the cultivation of anaerobic bacteria, an aluminum pressure cooker being used as the anaerobic jar.

Substitution of bromthymol blue for litmus in routine laboratory work, H. R. BAKER (*Jour. Bact., 7 (1922), No. 2, pp. 301-305*).—Among the advantages claimed for bromthymol blue as a substitute for litmus in routine laboratory work are that it is easier to prepare, it includes the neutral point in its range of H-ion concentration, it does not inhibit acid production, and it is not reduced by microbial action. It is also noted that the reaction of a carbohydrate medium containing bromthymol blue can be recorded at any time during incubation and can be read by artificial light.

The microscope in the mill, J. SCOTT (*Liverpool: North. Pub. Co., Ltd., 1920, pp. X+246, figs. 124*).—This volume, which is made up of articles appearing serially in *Milling*, includes descriptions with illustrations of the microscopical appearance of wheat, barley, corn, oatmeal, Chinese flour, the proteins of flour, and aluminum hydroxide in flour; microscopical changes occurring during the conditioning or tempering of wheat and the hydrolysis of starch; and chapters on saponins, corn cockle, the corn ergot fungus, white-head disease of wheat, microfungi of grain, corn rusts, rope in bread, the wheat midge, the corn sawfly, grain weevils, the Mediterranean flour moth, and spontaneous combustion of corn.

Some microchemical tests for alkaloids, C. H. STEPHENSON (*Philadelphia and London: J. B. Lippincott Co., 1921, pp. [3]+110, pls. 27*).—This volume is

the outcome of microchemical examinations of alkaloids at the Bureau of Chemistry, U. S. D. A. In all 64 alkaloids have been tested, but owing to the doubtful purity of 13 of them only 51 are described. Detailed descriptions are given of the tests, and the most characteristic crystal formations are illustrated by microphotographs. The volume includes a section by C. E. Parker on the chemical examination of the alkaloids used.

Apparatus for the determination of hydrogen-ion concentration.—**Application to the detection of mineral acids in vinegar**, A. KLING and MR. and MRS. A. LASSUREUR (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 3, pp. 165-168, fig. 1).—A simple apparatus for the electrometric determination of H-ion concentration is described, and data are presented on determinations of the H-ion concentration of vinegar before and after adding small amounts of sulphuric acid. While the pH values of the unadulterated vinegar samples varied from 2.54 to 2.84, those of vinegar containing traces of sulphuric acid never exceeded 2.02. The authors are of the opinion that either the electrometric method or the colorimetric method, using thymosulphophathalein, is suitable for detecting adulteration in vinegar.

The effect of H-ion concentration upon the determination of calcium, A. T. SHOHL (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 527-536).—The zone of H-ion concentration most favorable for the determination of calcium by the McCrudden method (*E. S. R.*, 23, p. 9) has been found to lie between pH= and pH=5.6. Beyond these limits on the acid side calcium oxalate is dissolved, and on the alkaline side magnesium ammonium phosphate is precipitated. It has been found to make no difference whether the acidity is regulated by acetic acid and sodium acetate mixtures or by adding ammonia to the acid phosphates present.

A rapid and accurate method for calcium in urine, A. T. SHOHL and F. G. PEDLEY (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 537-544).—The method described is essentially the volumetric procedure recommended by McCrudden, with the exception that the contamination of the precipitated calcium oxalate with uric acid is avoided by preliminary oxidation of the urine with ammonium persulphate. In carrying out the subsequent precipitation of the calcium oxalate, the H-ion concentration is adjusted to the limits suggested in the previous paper by using one or two drops of methyl red and adding ammonium hydroxid to the proper end point.

Investigations on the nitrogenous metabolism of the higher plants.—**I, The isolation of proteins from leaves**, A. C. CHIBNALL and S. B. SCHRYVER (*Biochem. Jour.*, 15 (1921), No. 1, pp. 69-75).—Essentially noted from a preliminary report (*E. S. R.*, 44, p. 504).

Is lipase a normal constituent of cow's milk? L. S. PALMER (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 51-63).—Experiments begun at the Missouri Experiment Station and completed at the Minnesota Experiment Station are reported in which attempts were made to detect the presence of a lipase in cow's milk by the technique employed by Rogers, Berg, and Davis (*E. S. R.*, 27, p. 179), with various modifications. In no case was sufficient evidence obtained to show that cow's milk normally contains an active lipolytic enzyme.

Proof of the presence of lipase in milk and a new method for the detection of the enzyme, F. E. RICE and A. L. MARKLEY (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 64-82).—Previous methods for the detection and determination of lipase and their application in attempts to prove the presence of lipolytic enzymes in milk and milk products are reviewed, and a new method is described by means of which the presence of lipase in milk is considered to have been positively demonstrated.

In the method described cream of high fat content, heated to destroy any lipase present, is used as the substrate, and the medium is saturated with sucrose which serves as a preservative, preventing the growth of bacteria but not interfering with enzym action. Acidity is determined at the beginning and end of the digestion period by diluting an aliquot of the sample with about five times its weight of distilled water and titrating to neutrality with N/10 NaOH, using phenolphthalein as indicator. The principal advantages of the method are considered to be the fact that a natural fat is employed which is well emulsified, and the sugar serves to increase the viscosity of the mixture to such an extent that there is no separation of fat for a long time. While an increase in acidity can be detected even at room temperature, the enzyme is found to be much more active on incubation at from 38 to 40° C. That the increase in acidity is due to a lipase present and not to bacterial action was shown by the fact that the bacterial counts in all mixtures were low and tended to decrease as the acid production went on, that the rate of acid production increased regularly with the amount of raw milk added, and that the greatest rate of reaction took place at the beginning of the digestion period.

The presence of lipase in milk is thought to explain certain cases of rancidity of butter and cheese, sweetened condensed milk, whole milk powder, etc.

A study of the chemical and physical properties of remade milk, L. S. PALMER and C. D. DAHLE (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 1-13, fig. 1).—This is a report from the Minnesota Experiment Station of an examination of the physical and chemical properties of milk remade from each of the three types of powdered milk at present on the market (drum, pressure spray, and centrifugal spray processes), and also of milk reconstructed from skim milk powder, water, and sweet unsalted butter. An ordinary egg beater and Dazey churn were used in remaking the milk from whole milk and partially skimmed milk powders and water, and a De Laval emulsor in reconstructing milk from skim milk powder, butter, and water. Tap water at a temperature of from 60 to 65° C. was used in all the experiments except those on freezing point, specific conductivity, and buffer action, in which distilled water was used.

The various samples of milk were prepared according to the directions given by the manufacturer and were then tested for freezing point by the Hortvet method (E. S. R., 45, p. 506). The freezing temperatures of normal cow's milk and of the various remade milks were as follows: Normal cow's milk -0.555° , drum process -0.655 , pressure spray -0.545 , centrifugal spray -0.500 , and reconstructed -0.560° . These results show that the manufacturers of the drum process partly skimmed milk powder recommend slightly more powder than necessary and the manufacturers of the centrifugal spray process powder slightly less powder than is needed to secure normal freezing point results.

For the other determinations the milks were prepared in such proportions as to give a normal freezing point. For the drum process powder this was found to be 10.6 per cent, for the centrifugal spray 12.8, and for the pressure spray 12.5 per cent powder, and for the reconstructed milk 9.16 per cent powder and 4.16 per cent butter. The specific gravity was determined at 60° F. two hours after the samples were prepared. The specific conductivity was determined in a Freus cell at 25° C. Viscosity determinations were made with a McMichael viscosimeter, observations at 25° being made (1) while the milk was fresh and (2) after standing for 24 hours at 7°. The results of the various determinations are presented in the following table. In all except the freezing point determination the milk used as a standard was freshly pasteurized.

Freezing point, viscosity, and specific conductivity determinations in remade milks.

Kind of milk.	Freezing point.	Viscosity at 25° C.		Specific conductivity.
		Fresh	After 24 hrs. at 7°.	
Normal.....	* C.	<i>Centipoise.</i>	<i>Centipoise.</i>	<i>Mho.</i>
Drum process.....	—0.555	1.39	3.25	0.00547
Pressure spray.....	— .550	7.36	5.91	.00525
Centrifugal spray.....	— .545	1.79	3.64	.00545
Reconstructed.....	— .548	2.25	4.10	.00560
	— .560	1.94	2.29	.00570

A comparison of the figures in the above table shows that the specific gravity of the remade milk lies within the limits of variation of fresh milk. The viscosity of the remade milks is higher than normal, probably as a result of the alteration of the colloids during the process of drying. The specific conductivities of all but the drum process milk are within the normal limits, the high conductivity of the latter being attributed to partial skimming of the milk.

Other physical features noted are the failure of cream to rise appreciably on any except the milk made from the centrifugal spray powder and the separation of solids not fat in some of the samples, notably the drum process.

The chemical properties studied included determinations of soluble protein, as giving an index of the maximum temperature employed during the drying process. The values obtained were normal milk 0.64 to 0.77 per cent, centrifugal spray 0.70, pressure spray 0.56, reconstructed 0.52 and drum process 0.46 per cent. These figures show that in all cases except the centrifugal spray process the temperature must have reached 72°. The decreasing values in the order named are considered to indicate increasing heat employed in the various processes.

In tests of the rennet coagulability of remade milk with the use of the Marshall rennet cup the milk from the centrifugal spray powder was found closely to resemble pasteurized milk both as to speed of coagulation and character of clot. The pressure spray milk ranked next, more time being required and the curd being less firm. The drum process milk and the reconstructed milk failed to clot.

The buffer values of the milks toward both acid and alkali, as determined by treating 25 cc. portions with increasing amounts of N/10 lactic acid and lime water, respectively, and determining the H-ion concentration electrometrically, were in all cases less than that obtained with natural milk.

Tests for peroxidase by both the Storch and guaiac tests gave results which could not be distinguished from raw or pasteurized milk except in the case of the drum process milk.

A color test for "remade milk and cream," O. L. EVENSON (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 97-101).—A qualitative test for distinguishing natural pasteurized milk from mixtures of natural and remade milk is reported from the Bureau of Chemistry, U. S. D. A. The test is based upon the discovery that when the washed curd of the product made from milk powder is dissolved in sodium or potassium hydroxid a yellow color develops in a few hours, while in that of natural pasteurized milk no color develops. It is thought that the yellow color is due to the presence in the curd of a compound of lactose formed by the action of heat and desiccation in the manufacture of the milk powder. The technique of the test is described for both milk and cream.

Fat analysis of milk powder, G. C. SUPPLEE and B. BELLIS (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 39-50).—The results are reported and discussed of a comparison of different methods of determining the butter fat content of dried milk made by the Just double roller process. In 69 comparisons of duplicate determinations by the Roese-Gottlieb (Mojonnier) method, there was an average variation of 0.147 per cent, a maximum variation of 0.49 per cent, and a minimum of 0, while in 20 comparisons of duplicate determinations by the simple ether extraction method the corresponding average, maximum, and minimum variations were 0.369, 1.29, and 0.05 per cent, respectively. The results by the ether extraction method were on the average about 0.25 per cent lower than by the Roese-Gottlieb. The Redmond method (E. S. R., 28, p. 113) was compared with the Roese-Gottlieb in duplicate analyses on 9 samples, the results of which indicate that the latter is much more accurate.

The modified Roese-Gottlieb technique, in which extractions are made from an acid medium instead of an alkaline, gave higher results in the majority of cases than did the extraction from an alkaline medium.

Sucrose determination in molasses by the Clerget method with the use of basic lead nitrate and aluminum sulphate as clarifying agents, H. KALSHOVEN and C. SIEJMAN; (*Arch. Suikerindus. Nederland. Indië*, 29 (1921), No. 29, pp. 989-999; also *Meded. Proefsta. Java-Suikerindus., Chom. Ser. No. 6* (1921), pp. 11).—The authors recommend the use of basic lead nitrate and aluminum sulphate for the clarification of sugar solutions for the Clerget double polarization method. The solutions required are a saturated solution of lead nitrate prepared by dissolving 600 gm. of the salt in 1 liter of water, a saturated solution in water of aluminum sulphate, and an 8 per cent solution of sodium hydroxid. The sample, which should weigh 35.816 gm., is introduced into a 250-cc. flask and to it are added 30 cc. of the lead nitrate solution, and, after mixing, 30 cc. of the alkali solution. After making the solution to volume, a 100-110-cc. flask is filtered to the lower mark with the filtrate, and the aluminum sulphate solution added to complete the volume almost to the 110 cc. mark. The final adjustment is made with water, a little kieselguhr is added, and the liquid shaken and filtered.

New clarifying agent for the Clerget (double polarization) method, effecting a high degree of decolorization, H. KALSHOVEN and C. SIEJMAN (*Internatl. Sugar Jour.*, 23 (1921), No. 275, pp. 627-629).—An abridged translation of the paper noted above.

The complete applicability of the modified Clerget method, R. F. JACKSON and C. L. GILLIS (*La. Planter*, 66 (1921), No. 24, pp. 380-382; also in *Facts About Sugar*, 13 (1921), No. 1, pp. 10, 11, 14).—A continuation of the discussion previously noted (E. S. R., 45, p. 317).

Industrial utilization of fruits and vegetables, I. J. KOCHS and A. KNAUTH (*Die Industrielle Obst- und Gemüseverwertung*, I Berlin: Paul Ruters, 1919, pt. 1, pp. 279, figs. 70).—This is a reference book on the large scale manufacture of dried fruits and vegetables, sauerkraut and other fermented products, and fruit marmalades. A large section of the book is devoted to descriptions, with illustrations, of the necessary machinery and equipment.

The home manufacture of fruit products, W. W. CHENOWETH (*Mass. Agr. Col. Ext. Leaflet 32* [1921], pp. 44, fig. 1).—On the theory that fruit products are not used more extensively in the diet on account of a lack of knowledge concerning their real food value, their high cost because of the large amount of sugar used in their preparation, and "the cloying effect on the appetite of these rich products," the author has prepared this publication dealing with the food value of fruits and methods of preparing fruit products requiring

less sugar than the usual recipes, and consequently yielding products which are not so heavy and sweet as the old fashioned preserves. The products for the preparation of which detailed recipes are given include fruit butters, conserves, jams, jellies, preserves, spiced and pickled fruits, marmalade, grape juice, cider, and elder vinegar.

The production of pink sauerkraut by yeasts, M. B. FRED and W. H. PETERSON (*Jour. Bact.*, 7 (1922), No. 2, pp. 257-269).—An investigation is reported from the Wisconsin Experiment Station of the cause of the pink color often developing in sauerkraut. The color was found to be due to the growth of certain yeasts and torulae under conditions favorable for pigment formation. The chief factors responsible for the development of color are high temperature, high salt concentration, and high acid content.

The manufacture of alcohol from molasses, E. HUMBERT (*La. Planter*, 68 (1922), No. 13, pp. 206-208).—Some of the details of the process of the manufacture of alcohol from molasses are presented, together with brief information on production and by-products. It is stated that about 1 gal. of absolute alcohol can be made from 2.2 gal. of molasses containing 57.7 per cent of sugar.

Some experiments on the production of power alcohol and paper pulp from megasse, G. J. FOWLER and B. BANNERJEE (*Jour. Indian Int. Sci.*, 4 (1921), No. 15, pp. [3]+241-260, figs. 3).—Experiments are reported, the object of which was to obtain power alcohol from the sugar and saccharifiable matter in megasse, and incidentally to obtain fiber suitable for paper making from the residue. Preliminary experiments showed that dilute sulphuric acid was a better hydrolyzing agent than either dilute sulphurous acid or sodium bisulphite. Owing to its corrosive action hydrochloric acid could not be employed as satisfactorily in the apparatus available.

The general method followed was to heat the megasse in a lead or earthenware container placed inside an ordinary copper or iron autoclave. The best conditions for hydrolysis were found to be an acid strength of from 0.35 to 0.5 per cent and a ratio of acid to fiber not exceeding 6 per cent of the weight of the fiber. A large proportion of acid tended to destroy the fiber and to produce nonsugars which interfered with the subsequent operations of fermentation.

The maximum yield was obtained in from 15 to 30 minutes, but there was not much loss when the heating was prolonged to two hours. The apparatus available did not permit of the pressure being raised beyond 65 lbs. to the square inch. The best results were obtained when the material was heated up as rapidly as possible to the required temperature and cooled as quickly as possible, so as to minimize the destructive effect of the acid on the fiber. The highest total percentage of sugar recovered was 36 per cent. The percentage of unexpressed sugar originally present in the megasse was found to be 7 per cent. If it is assumed that 1 per cent of the original sugar is lost during the operations of hydrolysis concentration, etc., it is concluded that 30 per cent is produced by the hydrolysis of the nonfibrous cellular tissue of the megasse. The saccharine solution obtained was not readily fermented by itself even after clarification with lime. However, a large percentage of it could be fermented when diluted with ordinary fermentable solution of sugar. The net yield of alcohol, apart from that derived from the sugar originally present, is then from 8 to 9 per cent, which compares favorably with the best results so far obtained from wood waste.

The manufacture of ethyl alcohol from wood waste, F. W. KRESSMANN (*U. S. Dept. Agr. Bul.* 983 (1922), pp. 100, pls. 3, figs. 10).—This bulletin

reports a systematic investigation of certain of the variables in the methods of obtaining ethyl alcohol from wood waste by hydrolysis with dilute acid and subsequent fermentation with yeast. Previous work on the subject, as reviewed from the literature, is criticized as aiming chiefly at an increase in the total yield of sugars rather than considering the factors influencing the fermentation of the sugars. The variables studied in this investigation include the influence of the temperature and pressure of digestion, length of the time of digestion, ratio of the water and of the catalyzing agent to the dry sawdust, concentration of the catalyzing agent in water, size of the sawdust, hogged slabs, etc., effect of adding the catalyzing agent after the preliminary heating of the wood, effect of varying the amount of bark in the sawdust, special chemical treatments other than or in addition to acid catalysis, yields from different species and mixtures, the fermentation variables, and the steam consumption for each ton of sawdust digested.

The hydrolysis of the wood was carried on in a rotary digester consisting of a thin, cast-iron, enamel-lined inner shell and an outer shell of steel, the two being separated by several inches. The inner shell, which had a total capacity of about 22 cu. ft., was so arranged that it could easily be taken out and replaced. The digester was filled and emptied through a pair of concentric manholes in the inner and outer shells. Separate pipes conducted steam to the inner shell and to the space between the two shells. A cast-iron tank lined with acid-proof enamel was connected with the digester in such a way that its contents might be introduced into the digester when the latter was under pressure. In the usual procedure the digester was charged with sawdust equivalent to about 100 lbs. dry weight (the exact weight and moisture content being reported), the dilute acid was then added, the manhole covers bolted on, steam admitted, and rotation begun. The admission of steam was continued until the desired pressure was reached and then regulated for the heating period, generally of 20 minutes. At the completion of the reaction the rotation was stopped and the vapors were blown off, condensed as rapidly as possible, weighed, and analyzed for volatile acid. The digester liquor, separated by centrifuging, was weighed and analyzed for acidity, total solids, dextrose, etc.

In conducting the fermentation the yeast used was a pure strain of *Saccharomyces cerevisiae* isolated from a yeast obtained from a Hungarian distillery producing alcohol from beet sugar molasses. The fermentation was started on a sprout mash made from 8.5 gm. of malt sprouts and 2.5 gm. of ammonium sulphate boiled for 15 minutes in 250 cc. of the wood sugar solution to be fermented, increasing volumes of the sugar solution being added from time to time during the fermentation.

Complete data for all the runs are given in a series of tables. The principal points established for coniferous woods by this study are as follows: The temperature and pressure of cooking should not exceed 7.5 atmospheres and should be reached in from 15 to 20 minutes. The digester contents should be cooked at the above pressure and temperature for 15 to 20 minutes. The ratio of water and of sulphuric acid (100 per cent) to the dry wood should be 125 parts of the former and from 1.8 to 2.5 parts of the latter to 100 parts of dry wood. Under these conditions, and making allowance for a distillation loss of 2.5 per cent, a yield of 25 gal. of 190-proof alcohol per dry ton has been obtained.

After the cooking the digester should be blown off as quickly as possible. If long-leaved pine or a similar resinous wood is used about 1 gal. of crude turpentine per cord can be recovered in the blow-off. With other coniferous woods the amount of turpentine and in all cases the volatile acid are not sufficient for recovery. Sulphuric acid, and possibly some sulphates, are considered the best

catalysts. Chlorids prohibit fermentation, but tannin in the concentrations ordinarily found does not.

The essential parts of a plant equipped to produce ethyl alcohol from wood are listed and described, and costs for alcohol production in such a plant are estimated. Under the best conditions it is estimated that a yield of 20 gal. a dry ton may be obtained. Assuming this yield, and a location in which a uniform and constant supply of wood for a period of 20 years, with plenty of water, and a nearby supply of sulphuric acid and lime is assured, it is estimated that the total cost of a gallon of 190-proof alcohol from a plant having a capacity of 2,500 or 3,000 gal. a day would be from 13.5 to 19.5 cts.

"The successful production of ethyl alcohol from sawdust seems to depend upon the proper design, equipment, and management of the plant, rather than upon the improvement of the chemical or fermentological features of the process. The problem involves the quick and efficient handling of large volumes of low-grade material under unusual technical conditions, the perfecting of the necessary acid-resisting pieces of apparatus, a study of the experience of the plants that have been built and operated, and the efficient utilization of material whose mere removal is now an expense. This industry unquestionably is worthy the serious study of experimental and practical investigators of the utilization of forest products."

Casein: Its preparation and technical utilization, R. SCHERER, trans. by H. B. STOCKS (*London: Scott, Greenwood & Son, 1921, 3. ed., rev. and enl., pp. VIII+213, figs. 17.*).—A third revision of the volume previously noted (E. S. R., 29, p. 312).

METEOROLOGY.

The influence of temperature and rainfall on the yields of certain kinds of wheat at Svalöf and Ultuna, Sweden, A. WALLÉN (*Geografiska Ann., 2 (1920), No. 4, pp. 332-357, figs. 3; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 12 (1921), No. 7, pp. 804-808.*).—The results of a series of observations on the course of meteorological factors and the growth and yield in grain and straw of three varieties of wheat are summarized.

Correlating the yield of grain with the temperature at different periods of growth, it appears that low temperature in autumn and high temperature during the rest of the growing season are necessary for a good crop. The correlation between rainfall and yield was variable and not very pronounced. The results of the investigations "are insufficient to enable accurate indications of the character and behavior of each variety to be formulated; data relating to the most important stages of the vegetative period, with the help of which the relationship between the plant and its environment would be more clearly indicated, are completely wanting. Hence the necessity of observations on the growth of the plant in open fields and the course of meteorological factors."

With this object in view the author has undertaken in Sweden a series of "bio-meteorological observations relating to each variety of the more important species of cereals" along the line of Azzi's work in Italy, using the international forms proposed by the latter for reporting the results.

What are utility seed corn types? T. A. KIESSELBACH (*Breeder's Gaz., 81 (1922), No. 18, pp. 585, 586, figs. 2.*).—This article, based upon experimental work at the Nebraska, Kansas, and other stations, brings out the fact that regional climatic and soil conditions control the character of the plant and the shape and size of the ear.

Climatic conditions and crop yields, P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt., 1920, pp. 6-8, 9.*).—A summary is given of observations on tem-

perature and precipitation at Morris, Minn., during 1920, as compared with the 12-year average, with brief notes on the relation of the weather conditions to crop growth.

The weather conditions were favorable for corn and hay, but wheat, oats, and barley made only average crops. The growth of grain was retarded by an excessively cold April, 7.3° F. below normal. Excessive rain in June, 9.04 in., or 5 in. above normal, benefited pastures and meadows but was disastrous to grains, resulting in small heads and an overproduction of straw. Because of the wet weather rust developed on wheat and oats early in July, followed by wheat scab, which caused even greater damage to the wheat than the rust. "Oats did not fill properly and barley was generally poor. The few seedlings of clover and timothy that survived the dry summer of 1919 were largely winter-killed, and a very small crop of clover was produced." In August and September the temperature was above normal, and there was sufficient precipitation for the corn crop. Killing frost did not occur until late in October, and the weather conditions were generally favorable for fall-sown crops. The total rainfall for the year was 25.04 in., as compared with a 12-year average of 25.97 in.

Weather records at lookout stations in northern Idaho, J. A. LARSEN (*Jour. Forestry*, 20 (1922), No. 3, pp. 215-219).—Observations on air temperature, relative humidity, and air movement at Forest Service fire lookouts in northern Idaho during the summer of 1919 are summarized and discussed with reference to forest fire protection.

Comparing the data so secured with results of similar observations at lower stations, it is shown that "the average daily wind velocities at the mountain stations are from two to three times that shown by the low stations." The records also show that "on the mountain there is very little difference in movement by night and by day—only a slight increase in the afternoon—but in the valley the air is almost still at night and shows the maximum movement in the afternoon."

In previous observations the relative humidity has been shown to be lower at night and higher during the day at a mountain station than at a low station. "From a standpoint of forest fires these differences in weather condition at high and low stations in summer explain why the fires burn better at higher than at lower elevations at night. The greater air movement fans the flames, supplies more oxygen, and the higher temperature keeps the relative humidity lower so that there is less atmospheric moisture to dampen the dead needles and moss. The high air temperature and low humidity at lower elevations during the afternoons produce more critical conditions than prevail on the mountains at this time of the day."

Meteorology report for 1920, F. E. HEPNER (*Wyoming Sta. Rpt. 1921*, pp. 137-140).—This is a summary of the thirtieth year's observations at the University of Wyoming, Laramie, on pressure, temperature, precipitation, wind, and cloudiness.

The mean pressure for the year was 23.044 in. The mean monthly temperature was 40.5° F. or nearly normal, although there were unusually wide variations. April was the coldest of record at the university, being 7.8° below normal. The last killing frost in spring occurred June 5, the first in autumn, September 26. The total precipitation was 15 in., 4.3 in. above the normal and the greatest recorded at the university. "The large excess was due principally to a single storm April 16 to 18, during which snow, equivalent to 3.5 in. of water, fell. A large percentage of this moisture sank into the ground, benefiting ranges and crops during the whole season, so that although the precipitation during June and July was below normal the ranges

did not suffer much. May was slightly above normal in precipitation and August had more than twice the usual amount, making the growing season very good as to moisture conditions."

SOILS—FERTILIZERS.

The factors determining soil temperature, B. A. KEEN and E. J. RUSSELL (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 211-239, figs. 13).—In a contribution from the Rothamsted Experimental Station, studies on the factors influencing soil temperature and the extent to which other measurements, such as of air, temperature, hours of sunshine, etc., can be made to give information as to soil temperature in cases where direct determinations have not been made, are reported.

The temperature readings were taken on a continuous self-recording soil thermometer buried at a depth of 6 in. in the bare soil at Rothamsted. The results obtained in summer were found to differ from those obtained in winter. In winter there was practically no variation during the day, although fluctuations sometimes extended over a period of several days, the maximum of one day being the minimum of the next. There was a marked daily variation in summer. The temperature rose for about 7 or 8 hours and fell for about 15 or 16 hours, there being often a flat period of varying duration at each end. The mean temperature was passed about midday and again about midnight. The maximum soil temperature was not very closely correlated with the number of hours of sunshine. On the other hand the extent of the temperature rise at about 6-in. depth was closely correlated with the amount of solar radiation, and to a less extent with the hours of sunshine. The extent of the daily rise was adversely affected by rainfall but apparently not by wind. No evidence was found of rainfall increasing the maximum temperature. The surface of the soil rose to a temperature considerably above that of the air. At 6-in. depth, however, the temperature wave was so damped that the maximum was approximately the same as in the air during summer, although it was about 3° C. lower in winter.

The cooling of the soil was increased by clear nights, but was retarded during autumn by rainfall. The cooling of the soil did not usually proceed as far as the cooling of the air. The maximum temperature at 6-in. depth during the summer was usually about 22° and the minimum about 18°, with a mean of about 20°. The mean value was found to show less relationship to radiometer or sunshine values than did the maximum temperature, but there was a traceable connection. The amount of soil moisture however, showed a tolerably clear connection, it being found that as the soil dried so it warmed, and as it became moist so it cooled. The transition from winter to summer values took place quickly. In early winter the cooling of the soil was also rapid.

These results are taken to indicate that the soil population enjoys a warmer and moister climate than that of the atmosphere.

A description and discussion of instruments used in these studies is included.

Frost and muck soils, G. BOUYOUKOS (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 85, 86).—It is stated that experiments to determine why plants freeze more quickly on some muck soils than on heavier soils have shown that the surface of the muck soil and the air above it are not as warm during the night as is the case with clay. It was found in one case that the temperature of the muck at the surface was 4° below freezing, while the temperature of the clay was almost 5° above freezing. During the day both soils had the same temperature. This is attributed to the lower heat conductivity of mucks and peats than of heavier soils.

The utilization of peat moors, A. SAUER, E. CANZ, and P. SCHICKLER (*Die Ausnützung der Torfmoore. Stuttgart: Konrad Wittwers, 1920, pp. 38*).—This publication contains papers on the geological occurrence and manner of formation of the peat moors of Wurttemberg, the utilization of peat moors, and the utilization of peat. The uses of peat for direct fuel, gas manufacture, and for briquetting are emphasized.

The determination of clay in heavy soils, A. F. JOSEPH and F. J. MARTIN (*Jour. Agr. Sci. [England], 11 (1921), No. 3, pp. 293-303*).—A critical examination of the so-called Sudan method for clay determination, as worked out by Beam (*E. S. R., 25, p. 513*), is described, and a comparison of this method with the methods in general use in England and America is reported.

The essential points of the method lie in (1) the use of sodium carbonate instead of ammonia as the deflocculating agent, and (2) the use of a camel's-hair brush for puddling the clay. It differs from the English and resembles the American method in that no preliminary acid treatment is used. The height of the sedimentation column is 10 cm. and the time of subsidence 8 hours. It was found that the method can be applied to a sedimentation or centrifugal process. The results agreed well with each other and with those obtained by the American method.

When modified by inclusion of acid treatment, by increasing the time of sedimentation from 8 to 24 hours and reducing the height of the column to 8.6 cm., the results agreed well with those obtained by the English method. It was found that treatment with acid, either in the preliminary operations or for deflocculating clay suspensions, may lead to uncertainty in the results, in some cases as it causes loss of clay by solution.

It was further found that the Sudan sedimentation method can be carried out in about one-eighth the time required for the English method, and the centrifugal in about one-third the time required for the American method. Preference is therefore expressed for the sedimentation method for general use.

The effect of rock on forest soils, O. TAMM (*Meddel. Statens Skogsför-söksanst., No. 18 (1921), pt. 3, pp. 105-164, pls. 2, figs. 10*).—Field studies on the influence of stones and their weathering on the general properties of forest soils, more particularly in the hyperite region of the Province of Värmland in southwest Sweden, are reported.

The two prevailing forest soils of the region are podsol and brown soil (braun erde). The former owes its formation to the prevalence of vegetation, forming raw humus. The latter is a mull or decomposed litter formation and under certain conditions, resulting in an excess of raw humus, can deteriorate into podsol. It was found that the most important weathering products of stones for forest soils are the lime salts. The occurrence in small quantity in soil of a constituent with a strong lime action was found to influence soil and vegetation. There was a minimum content of such a constituent below which no action was noticeable. This was lower for slopes than for flat soils. It was found necessary for a constituent with a very small lime action to be present in soil in considerable excess in order to influence vegetation, the minimum limit for such material being higher for slopes than for flat soils. A small content of a constituent of strong lime action was able to neutralize the influence of a large content of a constituent of weak lime action.

On the basis of their ability to yield up lime salts by weathering, the rocks of the region are divided into four groups, varying within rather wide limits. Where the lime action is weak, poor evergreen growths are found. Where gneiss and granite prevail, the soils are of medium quality and produce good evergreen forests. Where stones of higher lime action prevail, luxuriant pine or good deciduous forests are often produced.

Studies on the influence of hyperite, a stone similar to gabbro, on forest soils are also reported. The most hyperite was found to occur on the south slopes of hills. The first stage in the action of hyperite on soil occurs where the soils contain about 10 per cent hyperite, resulting in a forest podsol containing rather thin bleicherde mixed with decomposed litter. The humus content is raw and changes into litter with depth. A second stage occurs where the content of hyperite is greater and the slope is more flat than in the first stage. The soil becomes a good brown soil. The strongest action of hyperite on the soil takes place on steep hills where brown soil is formed equal in quality to good garden soil. The marked capacity of brown soil for moisture retention is attributed to its content of well-decomposed humus. Contrasted to this is the content of half decomposed plant remains in podsol, resulting in a low water retaining capacity.

A comparative study of two similar hyperite soils, both of the brown soil variety, one supporting a luxuriant evergreen forest and the other dwarf bushes and evergreens, was also made. It was found that the content of available lime as indicated by a 10 per cent ammonium chlorid solution was greater in the latter than in the former soil. The content of water-soluble lime was greater in the former than in the latter, however. It was found that proper cultivation and treatment can increase the lime action of hyperite soils.

Studies on the degeneration of brown soils to soils deficient in minerals showed that podsol usually occurs on subsoils rich in minerals, and that in beech forests, especially on soils deficient in minerals, the humus is raw and podsol is formed. Thus brown soils can under such circumstances degenerate into podsol.

It is generally concluded that brown soil can to a certain extent neutralize the action of a mineral soil deficient in lime. On the other hand, a rich mineral soil such as hyperite soil can neutralize the influence of a poorer soil such as podsol.

Soil survey of Johnson County, Iowa, W. E. THARP and G. H. ARTIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 52, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 390,400 acres in southeastern Iowa. The uplands throughout most of the country are strongly rolling. The relief of the three southeastern townships ranges from undulating to gently rolling, and there are a few areas in the northeastern and north-central parts that have very mild relief.

The prevailing soil types are silt loams of loessial origin. Practically all types are said to be acid, but calcareous material usually occurs at a depth of a few feet. Including meadow, muck, and riverwash, 27 soil types of 15 series are mapped, of which the Clinton and Tama silt loams cover 45.9 and 18.9 per cent of the area, respectively.

Soil drifting in Alberta, W. H. FAIRFIELD (*West. Canad. Soc. Agron. Proc., 1 (1920), No. 1, pp. 35-37*).—It is stated that the problem of soil drifting on the open prairie has reached serious proportions only in the southern part of Alberta. During the summer of 1920 an area of about 1,000,000 acres was badly blown, resulting in a crop loss varying from 2 per cent up to and over 75 per cent. The preventive measures recommended are early plowing or plowing only when the soil is in proper condition with regard to moisture, greater consideration of the implements used to destroy vegetation, the producing of a lumpy condition on the surface of an overworked summer fallow, and the general use of winter rye. With regard to implements, it is stated that the disk and other implements used to destroy weeds which also pulverize the soil must not be used.

Soil drifting in Manitoba, J. H. ELLIS (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 38-48).—This report deals with the location and extent of areas of drifted soils in Manitoba and with causes, damages, and preventive measures. It is pointed out that one of the prime causes of soil drifting is deficiency of root fiber, and a permanent remedy is therefore thought to consist in the development of that fibrous condition of soil which will bind the soil particles together and indirectly assist in increasing the moisture-holding capacity.

Soil drifting in Saskatchewan, R. HANSEN (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 49-59, pl. 1).—Information on the location and extent of areas of drifted soil in Saskatchewan is presented, and recommendations for preventive measures are discussed.

Partial sterilization of soil, G. RIVIÈRE and G. PICHARD (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 7, pp. 493-495).—Studies to determine the influence of partial sterilization of loam and sandy soils with sodium arsenate on winter and spring wheat, oats, and potatoes are reported.

It was found that sodium arsenate applied at the rate of 100 kg. per hectare (89 lbs. per acre) not only destroyed all the protozoa but had a harmful effect on wheat. When applied in amounts of from 21 to 42 kg. per hectare the protozoa were destroyed, but the bacterial content of the soil was increased. Both wheat and oat crops were considerably increased by such treatment, in some cases as much as from 25 to 50 per cent.

Influence of certain soil factors on the growth of tree seedlings and wheat, B. MOORE (*Ecology*, 3 (1922), No. 1, pp. 65-83, figs. 6).—Studies to determine the influence of humus in soil on tree growth, aside from its influence on the moisture-holding capacity of the soil, and the influence of alkalinity produced by calcium hydrate are reported.

In the humus studies three soils were used, representing two extremes, absence of humus and pure humus, and an intermediate condition or a mixture of sand and humus. The first soil was pure sand, the pure humus was a dark brown leaf mold not completely decomposed, and the intermediate soil was a mixture of these two in the proportion of 80 and 20 per cent by volume, respectively. In the alkalinity tests three soils similar to those described were also used. The trees used in the study were red pine, Jack pine, pitch pine, white cedar, and sugar maple. Wheat was also grown in the studies.

It was found that growth in height, root growth, and green weight were much greater on pure humus than on pure sand and were intermediate on a mixture of sand with 4 per cent of humus by weight. Height growth on humus continued until the middle of September, while on sand it fell off early in July, and on the mixture of sand and humus it diminished by the middle of July. The favorable influence of humus is attributed to its nitrogen content. Jack pine and pitch pine responded more to humus than red pine or cedar. Wheat responded markedly to the humus but less so than the coniferous trees except cedar.

Alkalinity produced by heavy applications of calcium hydrate was extremely unfavorable to all of the trees except cedar. Sugar maple transplants died within five days, with two exceptions. A large proportion of the seedlings of the other species died, and those which survived made poor growth. The conifer roots of alkaline soils were brown and shriveled. Alkalinity was found more unfavorable to trees than acidity of the same departure from the neutral point. The toxicity of the lime appeared to diminish somewhat after about 40 days' exposure but still remained strong enough to be very unfavorable. Wheat grew practically as well on the heavy limed as on the unlimed humus. Where the soils were lightly limed, growth in height, root growth,

and green weight on the sand and mixture of sand and humus equalled or surpassed that of the more heavily limed soils, in spite of 15 days' later start. On the lightly limed humus all species excelled those on the more heavily limed humus in all respects and to a marked extent. Wheat grew remarkably well on the lightly limed series, far surpassing that on the other soils.

Soil fertility investigations, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt., 1920, pp. 16-26, figs. 2*).—In a continuation of soil fertility studies previously noted (*E. S. R., 43, p. 627*), it was found in the phosphate-manure fertilizer experiment with potatoes, rutabagas, and oats that acid phosphate apparently gave results with potatoes for the first time. No effect of fertilizers was noted on rutabagas. Lime only slightly influenced the hay crop.

In clover and timothy utilization experiments on a rotation of potatoes, sunflowers, and oats, it was found that plowing under the grass did not materially stimulate yields, and in some cases it was followed by depressed production. In the case of potatoes a clear gain was indicated from pasturing the clover and timothy as compared with plowing it under or cutting it for hay.

In rotation experiments without clover or manure to indicate what happens in the absence of constructive management of timber soils, it was found that barley is worthless as a pioneer crop on cut-over timber soils or until the land has been improved. Oats were found to maintain a good yield and potatoes a fair yield. The influence of clover-timothy sod was much more pronounced than that of manure.

Sowing clover between stumps and pasturing it not only lessened the cost of clearing and provided profitable pasture but it had a striking effect on the first farm crop following stumping.

Experiments on the fertility of burned virgin mineral soil showed that although splendid grass seedlings followed where the forest fire was most intense, the first year's results with tilled crops pointed to contrary conclusions.

A study of the fertility of the soils of Greece, G. BOUYOUKOS (*Soil Sci., 13 (1922), No. 2, pp. 63-79*).—In a contribution from the Michigan Experiment Station, a report is presented on a study of the soils of Greece made by the late C. G. Hopkins, with the author as an associate. The studies included personal examination, chemical analyses, and pot culture and field experiments.

It is stated that the average yield of grain crops in Greece is low, that of wheat being only about 11 bu. per acre. These low yields are generally produced only once in two years because of the common practice of fallowing. The low yields of grain crops are attributed to (1) poor and unclean seed and weedy stand of plants, (2) insufficient rainfall, and (3) deficiency of nitrogen and phosphorus in most of the common soils and the almost complete failure to supply these elements in the form of fertilizers or manures. The chief limiting factor is therefore considered to be the loss of soil fertility.

Chemical analyses of samples of over 80 representative types of soils showed that the soils of Greece vary widely in fertility. Nitrogen was found to vary in an acre of 2,000,000 lbs. of surface soil from 1,500 to 5,000 lbs., phosphorus from 210 to 11,720 lbs., potassium from 2,520 to 64,490 lbs., calcium from 2,900 to 127,140 lbs., and acidity from 0 to the equivalent of 12,550 lbs. of limestone. With the exception of a few abnormal soils, all of the soils examined were well supplied with potassium. Limestone was also found to be abundant in most of these soils. Here and there acid soils were found, usually on level plains, ridges, hills, and plateaus which have lost their original supply of limestone and have not received additional supplies.

Chemical examination showed that the soils of mountain slopes, for which many plains soils have been abandoned, are usually richer in nitrogen and phosphorus than the plains soils. The soils richest in nitrogen and phosphorus, and usually the most productive, were found on the terraces of the mountain slopes, on the sides and bottoms of small valleys, and on the bottoms of big valleys overflowed with river water. The poorest soils in nitrogen and phosphorus, and usually the least productive, were found on level plateaus, tops of hills and ridges, and on some of the level plains which neither receive deposits by overflow nor lose partially depleted soils by erosion.

The nature of certain aluminum salts in the soil and their influence on ammonification and nitrification. I. A. DENISON (*Soil Sci.*, 13 (1922), No. 2, pp. 81-106).--In a contribution from the Illinois Experiment Station, studies on the nature of aluminum salts in gray silt loam, yellow-gray silt loam, yellow silt loam, brown silt loam, and an acid soil from the Rhode Island Station are reported. All the soils were acid or slightly acid.

It was found that soluble aluminum salts were not present in the acid soils used in the investigation. The results of the study are taken to indicate that aluminum salts, although perhaps occurring in some acid soils, do not contribute to their total acidity but are themselves produced by the action of the soil acids. Aluminum salts were found to stimulate ammonifying organisms, but acted adversely upon nitrifying bacteria in soil. This effect, however, was temporary only, as an acid soil seemed to have considerable capacity for inactivating toxic aluminum. Calcium carbonate is concluded to be the most effective material for reducing the toxic action of aluminum salts on nitrification.

The removal of mineral plant food by natural drainage waters. J. S. McHARGUE and A. M. PETER (*Kentucky Sta. Bul.* 237 (1921), pp. 333-362, fig. 1).--Analyses of more than 50 different samples of water from streams and springs in various parts of Kentucky and from points in other States to determine their content of the essential plant nutrients, including phosphorus, potassium, nitrate nitrogen, calcium, magnesium, sulphur, sodium, chlorine, and manganese, are reported.

It was found that the amount of mineral nutrients contained in such drainage waters varied with the nature of the strata through which they flowed. The drainage waters from limestone areas contained the greatest amount of mineral matter and those from sandstone areas the least. On the other hand, the drainage waters from sandstone areas contained more than twice as much potassium as those from limestone areas. The drainage waters from the highly phosphatic soils in the Blue Grass area contained the greatest amount of phosphorus. The greatest amount of nitrate nitrogen was found in drainage waters containing the greatest amount of soluble phosphorus, thus indicating a parallelism existing between the soluble phosphorus and nitrate nitrogen. High phosphorus content in soils is thought to accelerate the activity of nitrifying organisms. Drainage waters from small streams containing the greatest amounts of nitrate nitrogen did not contain the greatest amounts of mineral matter. The total mineral matter in solution in large streams was not much less than that contained in small streams flowing from limestone areas.

It is estimated that the value of the essential mineral nutrients carried into the Gulf of Mexico by the Mississippi River approaches four and one-half billion dollars per annum. The opinion is expressed that more extensive growing of cover crops on soils that would otherwise remain bare will conserve much of the mineral nutrients carried in solution and in suspension by drainage waters.

A comparison of the calcium content of some virgin and cultivated soils of Kentucky by an improved method for the estimation of this element,

O. M. SHEDD (*Kentucky Sta. Bul.* 236 (1921), pp. 305-330).—The results of determinations, by the method previously noted (E. S. R., 44, p. 19), of the total calcium content of samples of a large number of Kentucky soils, both virgin and cultivated, are reported and discussed. In nearly every instance it was found that cultivation has caused a considerable loss of this element. From this and previous investigations, which have included studies of several hundred samples of soils taken from nearly all the counties of the State, it has been found that the best types of soil usually contain the largest amounts of calcium, phosphorus, sulphur, and manganese, and vice versa.

Determinations of the easily soluble calcium content in many samples of soil showed that some distinctive differences exist in the relative solubility of this element in soils from different areas. Many soils were found to be so deficient in calcium that this constituent requires consideration as well as their low phosphorus and nitrogen supply. The application of from 1 to 2 tons of limestone or of rock phosphate per acre to some soils was found to add about as much calcium as the surface soil contains.

The organic phosphorus content of some Iowa soils, J. T. AUTEN (*Soil Sci.*, 13 (1922), No. 2, pp. 119-124).—Preliminary studies conducted at the Iowa Experiment Station on the organic phosphorus contents of silty clay loam, silt loam, and silty clay soils are reported.

It was found that the nitrogen-carbon ratio was the widest in the silty clay loam soil and the narrowest in one of the silt loam soils. The silty clay loam soil having the highest latent fertility and one of the silt loam soils having the lowest latent fertility showed the highest ratios of organic phosphorus to total phosphorus. With the exception of one of the silt loam soils, the ratio of organic to total phosphorus was fairly constant at all depths.

The organic phosphorus: nitrogen ratio showed a very striking contrast to the organic phosphorus: total phosphorus ratio. There was a wider ratio in the surface soils in all cases than in the subsoils in the former. The ratios of organic phosphorus to organic carbon varied so widely that no one ratio could be used for calculating phosphorus from organic carbon in the different soil types. No definite conclusions are drawn.

Some experiments on reclamation of infertile alkali soils by means of gypsum and other treatments, P. L. HIBBARD (*Soil Sci.*, 13 (1922), No. 2, pp. 125-134).—Experiments conducted at the California Experiment Station to determine the types of treatments necessary to restore fertility to certain alkali soils are reported.

The soils in general are classed as Madera fine sandy loam. The treatments included gypsum, additions of organic matter, and leaching. It was found that excessive salinity, which renders a soil infertile, may be removed by simple leaching with water. Excessive alkalinity of a soil due to sodium silicate, carbonate, or bicarbonate may be removed to some extent by gypsum, but to restore fertility it is necessary to leach the soil after adding the gypsum.

It was further found that surface application of water to pots of soil may remove so much of the alkalinity, or more especially the salinity, to the lower levels of the pot that germination and growth of plants may take place in the top soil which would otherwise be quite toxic. Increase of carbon dioxide in the soil atmosphere was found to lower the intensity of the alkalinity and to permit the growth of plants. Such increase of carbon dioxide was readily brought about by the decay of easily decomposed organic matter. When a soil contains 0.5 per cent or more of sodium salts, including some sodium carbonate, it is considered improbable that it can be made fertile by the addi-

tion of gypsum in any amount, because the reaction by which sodium carbonate is changed to sulphate tends to reverse. In order to prevent this reversal it was found necessary to remove the sodium salts by leaching or other adequate means. On account of the low solubility of gypsum it is considered impossible to increase its concentration in the soil solution sufficiently to prevent reversal of this reaction in the presence of an excess of sodium salts. It was not feasible to leach very alkaline soils without adding some flocculating agent, such as gypsum or calcium bicarbonate, in order to prevent puddling of the soil. Water of primary alkalinity was found to be not well adapted to leaching alkali soils.

It was found that when sodium chlorid or sodium sulphate is removed from a saline or from an alkaline-saline soil by leaching with water the soil is likely to show an increased intensity of alkalinity before all the sodium carbonate is removed. This was observed with all the soils used in the experiment. The intensity of such induced alkalinity may be sufficient to be toxic to some plants, but it is thought that the quantity will usually be so small that a moderate amount of carbon dioxide, such as the plant sets free or such as may be generated by decaying organic matter, will reduce the intensity to a point below the toxic limit.

Greenhouse and chemical laboratory work (*Indiana Sta. Rpt. 1921, pp. 38, 39*).—It is stated that greenhouse and chemical investigations on soil acidity problems have shown that soluble salts of aluminum are the main cause of the toxicity of acid soils, and that lime and available phosphates take these aluminum salts out of solution and destroy their injurious effect.

Pot experiments with various carriers of nitrogen have shown that the nitrogen in muck is practically worthless as a plant nutrient, being only 5 per cent as available as that in sodium nitrate. Neither air-dried nor kiln-dried muck proved to be of value, and both acid and neutral mucks were equally unavailable. These results are taken to indicate the importance of testing the quality of the nitrogen in commercial fertilizers as well as determining the quantity.

Lime and fertilizer tests, M. M. McCool and G. M. GRANTHAM (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 80-85, figs. 3*).—The results obtained in cooperative fertility projects on different soil types of Michigan are briefly reported and discussed.

[**Fertilizer experiments**], P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1920, pp. 8, 10-22*).—A continuation of phosphate fertilizer experiments begun in 1914 (*E. S. R., 44, p. 321*) is reported, showing the response of wheat, oats, barley, corn, and alfalfa to acid phosphate. For oats barnyard manure was about as effective as acid phosphate in increasing yields, while rock phosphate produced an average yield of about 2 bu. per acre less than acid phosphate. Barnyard manure was also effective with barley when used alone, but a combination of acid phosphate and barnyard manure was too strong and caused severe lodging, resulting in a decreased yield. Either rock phosphate or acid phosphate used with manure gave good results with corn.

Tabular data on rates of manuring and on the use of wheat straw and corn stover as fertilizers are also presented.

Fertilizer trials on common soil types, M. E. MCCOLLAM (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1922), No. 7, pp. 106-109*).—The results of fertilizer trials with clover and grass, oats, field peas, kale, potatoes, mangels, corn, and cabbage on some of the common soil types of western Washington are briefly presented and discussed.

The crust-forming action of magnesium salts (potash fertilizer salts), A. VON NOSTITZ (*Landw. Vers. Sta., 99 (1921), No. 1, pp. 27-40, figs. 2*).—

Experiments with several different types of soil varying from loam through fine sandy loam to pure quartz, to determine the action of the constituents of potash fertilizer salts, and kainit in particular, on the so-called crust formation of soils, are reported. Both chemical and mechanical studies were conducted.

The results are taken to indicate that the crust-forming action of potash fertilizer salts on soils is very largely due to their magnesium content. The indications are that crust formation is not so much the result of chemical decomposition or flocculation as purely mechanical cementation. The studies with quartz confirmed the latter view.

Commercial fertilizers, 1921. J. M. BARTLETT (*Maine Sta. Off. Insp.* 101 (1921), pp. 61-80).—This contains the guaranteed and actual analyses of 505 samples of fertilizers and fertilizer materials, including lime and limestone, collected for inspection in Maine during 1921.

Inspection of commercial fertilizers for 1921. H. R. KRAYBILL, T. O. SMITH, and C. P. SPAETH (*New Hampshire Sta. Bul.* 201 (1921), pp. 16).—This bulletin presents the actual and guaranteed analyses of samples of 104 brands of fertilizers and fertilizer materials collected for inspection in New Hampshire during 1921.

AGRICULTURAL BOTANY.

Specialization and fundamentals in botany. J. C. ARTHUR (*Amer. Jour. Bot.*, 8 (1921), No. 6, pp. 275-285).—According to the author, the consistent, effective, onward march of botany calls for careful balance between the attention given to specialization and that given to fundamentals.

Hereditary transmission of acquired characters and adaptation of bacteria. C. RICHET and H. CARDOT (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 26, pp. 1353-1358, figs. 3).—Taking account of the fact that heredity in bacteria differs from that in those forms in which reproduction is marked at the outset by the fusion of two gametes of different origins, the authors have studied the influence of toxic substances on bacteria showing under normal conditions exceptionally rapid multiplication and easy cultivation in series and having properties permitting quick estimation of their activity, lactic bacteria fulfilling these conditions. The method involved the estimation of the dosage required to diminish, by at least 50 per cent, lactic acid production during 24 hours.

These bacteria developed, markedly, adaptation to thallium nitrate. It was found that in the unpoisoned control medium the normal bacteria outgrew the ones which had developed in TINO_3 . In a 1 per cent solution of TINO_3 , the strain habituated to that compound outgrew the (normal) strain not habituated. In a 2 per cent solution, the habituated (adapted) strain developed apparently about as well as in the 1 per cent strength, while development of the unadapted strain was practically zero.

Adaptation to toxicity was not specific for thallium nitrate, nor was it even for metallic salts. It was greatest in case of TINO_3 and of arsenates, though observable with potassium bromid, saccharose, phenol, and salts of zinc, copper, and vanadium. In case of mercuric bichlorid the lactic bacteria, instead of becoming habituated to the poisonous solution, appeared to become more and more sensitive thereto.

The adaptation proved to be specific, strains accustomed to TINO_3 showing no increase of resistance to other poisons, and vice versa. After a period of depression in the thallium salt solution, development became about normal in that solution, the bacteria having developed complete resistance to its toxicity.

Bacteria cultivated in thallium during 3 or 4 months retained resistance to that toxicant for 20 days or more.

It is thought that adaptation is not gradual but sudden, involving something similar to mutation in higher forms. Changes in behavior in other ways mark the development of adaptation, fermenting power being notably increased. Theoretical and practical bearings are discussed.

Certain aspects of the problem of physiological correlation, C. M. CHILD (*Amer. Jour. Bot.*, 8 (1921), No. 6, pp. 286-295).—A review of data, observations, and inferences as detailed in contributions previously noted (E. S. R., 45, p. 337) is followed by a brief appraisal of various assumptions in connection with available facts related thereto.

Oenotheras varying as to chromosome number, C. VAN OVEREEM (*Bot. Centbl., Beihefte*, 38 (1921), 1. Abt., No. 1, pp. 73-113, pls. 6, figs. 2).—Among the detailed results of study applying to various species and hybrids of *Oenothera*, it is stated that triploid forms are found to be inconstant in the successive generations. This phenomenon is ascribed to irregular chromosome distribution during gamete formation.

The morphological continuity of Scrophulariaceae and Orobanchaceae, I. BOESHORE (*Penn. Univ. Bot. Lab. Contrib.*, 5 (1920), No. 2, pp. 139-177, pls. 5).—On the basis of the observations here detailed, the author holds that direct and distinct continuity can be established from nonparasitic through semiparasitic *Scrophulariaceae* to the most degraded parasites of the family, and that these again show direct continuity with the still more degraded and condensed parasitic types of *Orobanchaceae*.

A morphological and cytological study of reproduction in the genus *Acer*, W. R. TAYLOR (*Penn. Univ. Bot. Lab. Contrib.*, 5 (1920), No. 2, pp. 111-138, pls. 6).—The present account presents, after a brief historical review, sections on material and methods, floral and pollen development in *Acer negundo*, reduction and somatic divisions in other species, ovule development, fertilization and embryogeny, and seedling anatomy, with a bibliography comprising 32 titles.

The morphological constitution of cytoplasm, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 2, pp. 121-124, figs. 8).—Noting divergent views, the author claims, as definitely demonstrable, the presence in cell cytoplasm of three categories of structures, namely a chondriome of which one part in chlorophyllous plants is connected with photosynthesis; vacuoles; and granulations which are fatty in character.

A preliminary account of the meiotic phenomena in the pollen mother cells and tapetum of lettuce, R. R. GATES (*Roy. Soc. [London], Proc. Ser. B*, 91 (1920), No. B 638, pp. 216-223, figs. 2).—In a brief preliminary account of observations on certain meiotic phenomena in *Lactuca sativa* (Sutton Dwarf Perfection and a rogue therefrom), the author has touched upon some points regarded as of scientific interest. A very detailed study has been made, particularly of the history and variations of the chromosomes.

The terminal meristem of the root and its division into regions, H. BOUYGUES (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 19, pp. 926, 927).—The author distinguishes, as existing in tips of roots of phanerogams and in those of vascular cryptogams, two regions, one being internal, the prevascular meristem, the other external, the cortical meristem, completely enveloping the other. Modifications at points successively more distant from the tip are discussed.

Photosynthesis in the Rhodophyceae, R. WURMSER and J. DUCLAUX (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 24, pp. 1231-1233).—The red

pigment of algae, studied in the course of work previously noted (E. S. R., 45, p. 31), appears to be connected with chlorophyll assimilation in a manner analogous to the connection of the retinal purple with twilight vision. Attention is called to the facts that Rhodophyceae living in water near the surface become more and more greenish with increase of illumination, that species showing dark red color in their (normally deep water) habitat show a notable development of green on being removed to higher water levels, and that various Cyano-phyceae redden when living at a certain depth in water.

Experimentation carried out with *Chondrus crispus* and *Rhodymenium palmata* in regard to their comparative assimilatory activity shows that plants rich in phycoerythrin always assimilate more energetically than those which are poor in that component, red plants really containing more chlorophyll than green plants but showing sensibly the same lipochrome content. The ratio chlorophyll: lipochromes is abnormally lowered in those plants which are poor in phycoerythrin. A photochemical effect seems to be involved. The red pigment is destroyed by strong light, and a new relation is established between the rapidity of its destruction and that of the production of chlorophyll. The lipochromes, being stable and protected by chlorophyll and oxidation products, undergo little change.

The green forms are then regarded as abnormal, chemically speaking, and as having relatively weak assimilatory power. These facts confirm the view that phycoerythrin characterizes the forms in which normal physiological changes took place in strong illumination.

Recent studies on the vascular apparatus in plants, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 22, pp. 1071-1074, figs. 25) - Work on roots of barley and leaves of *Iris germanica*, previously noted (E. S. R., 45, p. 30), has been followed up with a study on other plants, mainly bean and pea.

It is stated that the vacuolar system in embryonic cells of higher plants often shows forms suggesting mitochondria. The methods of treating mitochondria, however, rarely stain and imperfectly preserve these so-called pseudo-mitochondrial forms, which are said to lack the histo-chemical characters of true mitochondria and which should be clearly distinguished therefrom. It is thought that these forms were erroneously compared by Dangeard with the chondriome of the animal cell, and that they more probably correspond to the formations in the animal cell known as the canaliculi of Holmgren.

Continuous renewal of nutrient solution for plants in water cultures, S. F. TRELEASE and B. E. LIVINGSTON (*Science, n. ser.*, 55 (1922), No. 1427, pp. 483-486, fig. 1).—A description is given of a method for securing a constant flow of nutrient solutions used in studies of the salt requirements of plants. The flow can be regulated as desired, and by this method the constant change in the proportions of the different salts in solution is overcome.

Studies in the mechanism of enzym action.—I, Rôle of the reaction of the medium in fixing the optimum temperature of a ferment, A. COMPTON (*Roy. Soc. [London], Proc., Ser. B*, 92 (1921), No. B 642, pp. 1-6, figs. 3).—It is known that in case of the enzym maltase (which requires an acid medium in order to act to best advantage) increase in the acidity of the medium beyond the optimum point leads to a fall of temperature optimum, the mechanism of this temperature effect appearing to be due to a certain displacement of the enzym caused by excess of acid. The experimentation herein described was instituted to ascertain whether, by adding to the quantity of enzym in action, this lowering of optimum temperature can be controlled.

The enzym used was the maltase of *Aspergillus oryzae*. The work, as presented in descriptive and graphical detail, indicates that the optimum tem-

perature of any ferment or ferment function occurring in a given enzymic preparation is independent of the concentration of the enzyme, the duration of the action and the H-ion concentration of the medium being constant.

Development of nitrogen and oil content in seeds of oil and fiber plants, KLEBERGER (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze*, 28 (1921), No. 1, pp. 2-5).—Tabulation and discussion are given regarding the percentage content in the green-ripe, the yellow-ripe, and the fully-ripe stage of poppy, rape, flax, hemp, and false flax, as regards nitrogenous materials, fats, and other components.

The present state of the question of carbon dioxide nutrition in plant culture, H. FISCHER (*Angew. Bot.*, 1 (1919), pp. 138-146).—Former (E. S. R., 42, p. 137) and recent studies are cited, with enumeration of the questions investigated or arising in the course of the work regarding the possibilities connected with increase of the carbon dioxide percentage in the environment of cultivated plants.

Carbon nutrition of plants, BORNEMANN (*Angew. Bot.*, 2 (1920), No. 9-10, pp. 284-290).—Studies are here sketched as supporting the view that in certain cases, where by optimal soil fertilization the assimilation of carbon dioxide is lowered through uptake of that carbon source from the surrounding confined air, the relatively small amount of carbohydrate present must serve principally to aid in working up the nitrogen furnished through the roots. The result is a lively growth leading to the production of numerous large leaves rich in chlorophyll and of an extensive root system. Plants which are limited as to carbohydrate supply store, bloom, and lignify sparingly and assume a form of growth resembling that produced by excessive shading.

The principal views for and against carbon dioxide manuring, E. REINAU (*Angew. Bot.*, 2 (1920), No. 9-10, pp. 290-302).—This is a critical discussion of views regarding the practicability of supplementing the aerial carbon dioxide supply available to economic plants.

The assimilation of carbon dioxide by green plants, P. MAZÉ (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 26, pp. 1391-1393).—Leaves of about 30 different plants were gathered under various atmospheric conditions and at once distilled without addition of water under reduced pressure at 60° C., the distillate being condensed quickly in cooled receptacles in order to lose no gaseous constituent. In nearly every case, ethyl alcohol, acetic aldehyde, and nitrous acid were present. Formic aldehyde could not be demonstrated, but other components were found that had not been announced previously, and these are discussed as to their characters and probable identity.

The action of soluble sulphates and chlorids on starch, H. COURTONNE (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 23, pp. 1168-1170).—A comparison is made of the action of the chlorids of calcium, barium, and magnesium on starch from rice, wheat, and maize as compared with the action of sulphates here typified by hydrated magnesium sulphate ($MgSO_4 \cdot 7H_2O$).

The law of minimum and stimulation in plants in relation to the Weber-Fechner law, A. RIPPEL (*Angew. Bot.*, 2 (1920), No. 9-10, pp. 308-317, fig. 1).—This is an outline, with discussion (having practical bearings), of the Weber-Fechner law, and of the Liebig law of minimum as developed and applied by Mitscherlich (E. S. R., 22, p. 223; 42, p. 719.)

The influence of bee breeding on fertilization and bearing in fruit trees, R. EWERT (*Arch. Bienenkunde*, 3 (1921), No. 3, pp. 1-11, figs. 2).—Systematic observations are detailed regarding the influence of bee visits in fertilization of blooms of different apple varieties, also the influence of rain and other factors in this connection.

A new and reliable indicator of smoke injury among deciduous trees. F. W. NEGER (*Angew. Bot.*, 1 (1919), pp. 129-138, figs. 2).—Laboratory experimentation on the effects of SO_2 in air (1:20,000 to 1:2,000) in contact with various forest growths is described as showing particularly sensitive trees to include ash, linden, and maple; less sensitive, oak; and very slightly sensitive, beech, apple, chestnut, mountain ash, and birch. The first three are, therefore, recommended to be used as detectors for SO_2 in small amounts.

Observations in the open air near smoke sources are detailed in connection with such modifying factors as cold, heat, and dryness. Observations are noted also regarding the presence or absence of lenticels and of cork, and their apparent connection with smoke injury.

A Madagascar breadfruit. H. JUMELLE (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 19, pp. 924-926).—The katoka, a tree allied to the breadfruits, said to be common in the western part of Madagascar, is described as a new species under the name *Treculia perrieri*. The wood is said to be valuable, and the fruit is edible and agreeable, having already become an article of export.

Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction (*U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos.* 50 (1922), pp. 83, pls. 6; 51 (1922), pp. 100, pls. 10).—These numbers give, respectively, descriptive lists of 466 lots of seeds and plants introduced during the period from January 1 to March 31, 1917, and 489 from April 1 to June 30, 1917, the more important collections being those of F. N. Meyer in Central China, and W. Popenoe in Guatemala.

FIELD CROPS.

[Field crops work at the Upper Peninsula Substation, Michigan], G. W. PUTNAM (*Michigan Sta. Spec. Bul.* 110 (1921), pp. 13-22, 23-26, figs. 11).—The results of varietal trials with oats, spring wheat and barley, corn, soy beans, field peas, root crops, and annual hay crops are reported, together with a brief account of the development and testing of pedigreed varieties of cereals. Experiments with sunflowers have been noted earlier (*E. S. R.*, 44, p. 530).

Work with potatoes included investigations on method and time of planting, cultural methods, fertilizing, seed treatment, seed selection, and other factors of potato production. Seed potatoes treated with corrosive sublimate before planting gave higher yields with a better quality of tubers than seed treated with formaldehyde, or seed dug in the spring, green-sprouted and untreated, or seed from ordinary cellar storage. Plantings made during the last two weeks in May gave a maximum crop for both Green Mountain and Rural varieties and plantings till June 10 produced fair returns and were sufficiently mature to store over winter, but seedlings during the last two weeks of June gave small yields with immature tubers. Green-sprouting is indicated as an advantageous practice when it is impossible to plant as early as desired.

[Report of field crops work at the Duluth Substation, 1920], M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt.* 1920, pp. 8-15, figs. 3).—The progress of experiments with various field crops is reported as heretofore (*E. S. R.*, 43, p. 636). Among the heavier yielding varieties of wheat were Preston with 17.1 bu. per acre, Arnautka with 12.9 bu., and Emmer with 18.7 bu. Imp. Ligowa with 77.7 bu., Irish Victor with 76.1 bu., and Victory with 75.3 bu. were first among the oats varieties in 1920; Svansota with 50.1 bu. was first in the barley tests; M. A. C. Robust with 20.5 bu. led the bean varieties; and spring rye produced 22 bu. per acre.

Northern- and southern-grown common alfalfa averaged 3.23 and 3.80 tons per acre, respectively, while the respective yields of seedlings of Grimm alfalfa made June 9, 12, and 30 were 3.31, 3.56, and 3.55 tons.

Analyses of silage made from sunflowers, potatoes, peas and oats, clover and timothy, millet, and sorghum are tabulated.

Seed potatoes treated with corrosive sublimate produced two-year average yields of 291.5 bu. per acre, with formalin 290.5 bu., with copper sulphate 230.5 bu. and untreated seed 292.5 bu. In 1920, a season characterized by considerable rainfall in the spring months, potatoes given level cultivation produced 234.6 bu. per acre, while those given ridged cultivation made 256.6 bu., reversing the results obtained in 1919, a relatively dry season.

[Report of field crops work at the Morris, Minn., Substation, 1920], P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1920, pp. 22-36*).—The further progress (E. S. R., 44, p. 330) is reported of experiments including variety and cultural tests with cereals, legumes, and potatoes, and various rotations with grain and hay crops.

The results thus far in alfalfa rotations indicate corn to be the best crop the first year after breaking the alfalfa sod unless a liberal supply of moisture is present, when grain crops have given heavy yields. The crops of following years show yields above the average, and returns to date indicate that alfalfa, corn, and grain crops can be grown successfully in rotations in west central Minnesota.

Outstanding in acre yields in the variety tests of 1920 were Minnesota No. 184, an improved Manchuria barley, with 32.1 bu.; Marquis, Preston, Kubanka, and Mindum wheats with yields from 12.7 to 11.9 bu. per acre; Sixty Day and Iowa No. 103 oats with 39.1 and 37.4 bu., respectively; Great Northern field beans with 17.2 bu.; Elton soy beans with 34.9 bu.; and Minnesota No. 13 corn with 60.3 bu. Grimm and Turkestan alfalfa showed the highest yields in the 1920 nursery rows.

Green Mountain with 198 bu. was the best yielding late potato and King next with 155 bu., while Irish Cobbler with 176 bu. was the best early variety and was followed by Early Ohio with 153 bu. Early Ohio potatoes sprayed three times with Bordeaux mixture for early blight averaged 141 bu., with a higher yield of larger and more mature tubers than untreated stock, which produced 132 bu. Potatoes given level cultivation throughout the growing season yielded 138 bu., while those ridged averaged 135 bu., confirming the experience of the previous year. Seed pieces planted 2, 3, 4, and 5 in. deep produced 165, 170, 141, and 121 bu. per acre, respectively. The data seem to indicate that the 3-in. planting will produce the heaviest yield, and that deeper planting will produce larger but fewer tubers.

Grain mixtures and root crops under irrigation, P. V. CARDON (*Montana Sta. Bul. 143 (1921), pp. 3-14*).—The information presented is based on results of experiments conducted at the station since 1911 with different grain mixtures and with root crops under irrigation.

Grain hay made from different mixtures of wheat, oats, barley, and peas sown at the basic rate of 2 bu. per acre equaled or exceeded in a season any other hay crop tested, except the hardier strains of alfalfa, clover, and vetch. Combinations of oats and barley gave the highest average yields both of grain hay and of grain, although the three-crop mixtures generally averaged slightly higher in grain-hay production, and some of these gave more straw. Besides producing approximately 1.5 tons of grain per acre, the mature mixtures gave average yields of straw which, although a poorer quality of roughage, were about equal to the grain-hay yields from the other mixtures. The total acre

yields from different combinations of wheat, oats, and barley averaged less than those from the same crops grown alone. No advantage in mixing the grain crops was apparent so far as grain and straw yields were concerned.

Mangels were the highest yielding root crop grown, 18 varieties averaging 25.9 tons of roots per acre during a six-year period as compared with 19.6 tons, the average of 5 varieties of rutabagas, and 13.7 tons, the average of 9 varieties of carrots. During two years, 3 varieties of turnips averaged 18.3 tons per acre. The leading varieties of root crops included Banes, Mammoth Long Red, Giant Feeding Sugar, Golden Tankard, and Mammoth Golden mangels; Chateau, Oxheart, White Belgian, and Mastodon carrots; Purple Top and Mammoth Russian rutabagas; and Kangaroo, Elephant, and Canadian Gem turnips.

Variety testing and crop improvement [in Nevada] (*Nevada Sta. Rpt. 1920, p. 11*).—In a continuation by C. S. Knight of work already noted (*E. S. R. 43, p. 228*), White Club wheat was the highest producer in both row and plat tests and was followed in order by Galgalos Fife, Chul, Colorado No. 50, New Zealand, and Marquis. It is said that Marquis commands a premium at the mills which more than offsets its somewhat lower yield. Early Mountain oats and Blue Ribbon barley are also indicated as outstanding. As in previous years, Russian sunflowers, with 20 tons of silage per acre, decidedly outyielded both Leaming corn and Sudan grass.

[Report of the] agronomy department, A. F. VASS (*Wyoming Sta. Rpt. 1921, pp. 118, 119*).—Potatoes, sunflowers, and summer fallow differed but little in their influence on the following grain crop, whereas the amount of alfalfa growth in the grain depressed grain production on alfalfa ground. The detrimental effect of sunflowers on the succeeding crop seems to be largely a question of moisture and physical condition of the soil.

The leading varieties of cereals and their acre yields were as follows: Oats, Silvermine 50.2 bu., Colorado 37.49.6 bu., Banner 44.7 bu., and Swedish Select 44 bu.; wheat, Kubanka 28 bu., Red Fife 24.9 bu., and Marquis 24.4 bu.; and barley, Charlottetown 35.4 bu., Trebi 34.3 bu., and Hannechen 33.2 bu. The Pearls led in potato production, with King second and Netted Gem third.

Short season hay crops, C. R. MEECE (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 72, 73, fig. 1*).—Sudan grass with 3.33 tons per acre gave the highest average yield of air-dry hay in tests of short season hay crops from 1919 to 1921, inclusive; millets ranged from 3.25 tons with Golden to 1.91 tons with common; and soy beans, oats and vetch, oats and peas, and oats alone produced 2.67, 1.99, 1.78, and 1.77 tons respectively. Hubam sweet clover made 1.36 tons per acre in comparison with 1.42 tons from first-year biennial white sweet clover, which also had the greater root development.

Hardigan alfalfa, F. A. SPRAGG and E. E. DOWN (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 74, 75*).—Hardigan alfalfa is described as a new, hardy, disease-resisting variety developed by the station as the result of 16 years of alfalfa breeding work. When leaf spot defoliated the alfalfa in 1914, this strain was able to reset leaves on its old stems and produce seed, whereas other strains sent up new growth from the roots and produced only vegetative growth. The variety is considered worthy of note for both seed and hay production.

Irrigation of alfalfa, W. L. POWERS and W. W. JOHNSTON (*Oregon Sta. Bul. 189 (1922), pp. 36, figs. 24*).—Practical instructions are offered for handling the crop under irrigation, the different methods of applying water to alfalfa are outlined and compared, and the results of various irrigation experiments with alfalfa in Oregon and other States are summarized.

Duty-of-water experiments in 8 western States indicate that a good return per unit of water is 0.2 ton of alfalfa per acre-inch, or a little over 2 tons

per acre-foot. As an average of 43 net duty-of-water trials in eastern and southern Oregon, the maximum yield per acre-inch was secured with 15.5 in., 3.96 tons of hay per acre being obtained, while increasing the average depth to 24.15 in. gave an average maximum acre yield of 4.40 tons. Under subhumid conditions on a silty clay loam soil at the station, 5.5 in. depth gave a maximum yield per acre-inch averaging 4.37 tons per acre. Increasing the depth to 9.06 in. increased the yield to 5.04 tons.

The maximum net profit per acre with irrigated alfalfa is realized with a smaller amount of water than is required for a maximum acre yield but with a little more than is needed for a maximum yield per acre-inch. The water requirement of alfalfa for plats giving the maximum net profit was 739 lbs. of water per pound of dry matter, or 5.23 in. per ton of dry hay. Using these data as the basis, a 3-ton arid region would need from 15 to 18 in. of usable water, and a 6-ton region from 30 to 36 in. Although this applies fairly well to conditions in eastern Oregon and in some of the other irrigated sections, some modification will be necessary with subirrigation, very high yield, very fertile soil, or very coarse soil.

Proper irrigation, fertilizers, and crop rotations are indicated as important factors in improving the soil solution and lessening the irrigation requirement. A study of the water requirement for dry alfalfa and light, medium, and heavily irrigated alfalfa at the station shows that moderate irrigation reduced the water requirement to considerably below that of the dry plats, as the water comes during the best growing weather. With heavy irrigation, water is wasted and water requirement greatly increases. Applications of farm manure and sulphur substantially increased the average yields per acre and acre-inch and reduced the water requirement. To further aid in the economical use of water, alfalfa should be fed on the farm to conserve fertility, and alfalfa land should be broken up every few years to loosen the soil and market the stored nitrogen and humus in cash crops.

Marketing broom corn, G. B. ALGUNE (*U. S. Dept. Agr. Bul. 1019 (1922), pp. 32, pls. 4, figs. 6*).—The use and importance of the broom corn crop are indicated; its preparation for the market, including harvesting, threshing, curing, and baling, is outlined; and the methods employed in marketing, storing, and transportation are described. The factors entering into classification and usually considered in sampling are touched upon briefly.

Varieties of corn in Kansas, O. C. CUNNINGHAM and B. S. WILSON (*Kansas Sta. Bul. 227 (1921), pp. 40, figs. 9*).—During the period 1911 to 1919, inclusive, between 150 and 200 variety tests of corn were conducted annually throughout the State in cooperation with farmers. Some of the outstanding principles of corn production derived from the results of these tests may be stated as follows:

Where moisture or plant food is the limiting factor, the variety should be of such size as to utilize the available supply to the best advantage. Because of seasonal variations, no one variety will consistently prove superior to all others in a given locality. Thoroughly acclimated varieties give the best results, but when necessary to use imported seed corn it should be secured from an environment similar to that in which it will be grown. Introducing seed corn from a relatively unfavorable environment to a more favorable one is considered better than from the reverse. Varieties of corn developed under adverse climatic conditions in western Kansas are usually more vigorous and hardy than varieties similar in size developed in the Corn Belt States.

Brief histories and descriptions are given of the leading varieties grown in the State.

Varieties of corn of Kansas, C. C. CUNNINGHAM (*Kans. State Bd. Agr. Rpt.*, 22 (1919-20), pp. 111-131, figs. 8).—Essentially noted above.

How many corn plants per hill? (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 3-4, p. 49).—The 15-year average acre yield of dry shelled Clarage corn, checked 42 by 42 in., at the station amounted to 32.4 bu. with 1 plant per hill, 51.4 bu. with 2 plants, 62.2 bu. with 3 plants, 65.6 bu. with 4 plants, and 64 bu. with 5 plants per hill. The tendency was for the thin stand to lead during years of low yield and for the thick stand during years of high yield.

Water-stress behavior of Pima cotton in Arizona, C. J. KING (*U. S. Dept. Agr. Bul.* 1018 (1922), pp. 24, pls. 4, figs. 3).—A study of the behavior of Pima cotton when grown under different conditions of soil moisture and available plant food in the Salt River Valley of Arizona was made in 1919. The average period of maturation for 3,319 bolls of Pima cotton was 68 days. In Arizona, early bolls mature within a very much shorter period than later bolls; those developed from flowers blooming in July required an average of 27 days less for maturation than from flowers blooming in September.

Plants producing the most vegetative growth appeared to suffer most frequently from water stress, remaining longer in a wilted condition between irrigations and showing an earlier recurrence of wilting after the irrigation period. The lack of appreciable differences in size or distribution between the roots of large plants and small plants seems to indicate that a limiting root system may have an important bearing on the water-stress behavior of the largest plants. Most of the taproots of both large and small plants extended deeper than 7 ft., and one followed to its greatest depth was 10 ft. 8 in. long. Many secondary roots extended to great depths and apparently shared the function of the taproot. The greatest quantity of water was removed by the plants in a plat where the soil moisture content had been kept highest throughout the season, and which also produced 1,413 lbs. more dry matter per acre than a plat irrigated only three times.

The severe water stress frequently exhibited by plants possessing large areas of leaf surfaces and the shedding of squares and bolls are apparently not always induced in Arizona by a lack of available moisture throughout the soil mass, but may be due to a reduction of moisture in the soil immediately surrounding the roots more rapidly than can be restored by capillarity. An important relation is apparent between the increase of the shedding rate (based on the number of bolls available for shedding) during the first two months of the flowering season and the gradual reduction of the moisture content in the lower soil layers.

The mean interval between the opening of the flower and the completion of the shedding process was approximately 10 days. The period tended to increase as the season advanced, but fluctuation was great even near the end of the season, and a heavy rain materially shortened the interval between flowering and shedding.

In late summer a depression in the rates of growth and flowering was shown much earlier in the large plants than in the smaller plants. After this retardation began the large plants never again exhibited as prompt or vigorous a response to irrigation as the smaller plants. Plants receiving irrigation water soon after the first flower buds began to form, and frequently thereafter, produced a greater stem growth and more flowers during the first 45 days of flowering than plants not getting water until 16 days later. Plants in soil supplied sparingly with water throughout the season produced more bolls late in the season than plants well provided with soil moisture. The highest "potential seed-cotton production" per plant by October 1 was on a plat sparingly sup-

plied with water, while the highest actual yield of seed cotton was produced on the plat where by comparatively early irrigation the plants had been stimulated to set more than half of their total number of bolls during the first half of the flowering season.

"The data indicate that effort should be made to stimulate the setting of fruit to the fullest extent during the months of July and August especially in areas frequently visited by comparatively early frosts, since the number of bolls set during this period largely determines the extent of the crop."

Marketing cotton seed for planting purposes, J. E. BARR (*U. S. Dept. Agr. Bul. 1056 (1922)*, pp. 24, figs. 7).—Of over 500,000 tons of seed required to plant the 35,000,000 acres annually devoted to cotton production in the United States, it is estimated that in 1920 about 68 per cent was produced on the farm where used, 14 per cent was obtained from other farms, and 18 per cent was secured from dealers. While the number of persons and concerns dealing in cotton seed for planting purposes and the total volume of their annual business have increased steadily, comparatively little effort has been made to improve the commercial and agricultural value of their stock.

This bulletin points out some of the fundamentals in seed selection, improved methods of preparation, storage and marketing, and ways of overcoming or eliminating some of the unfair and unscrupulous practices said to exist in selling cotton seed for planting, in order to aid all classes of dealers to make their product approach the ideal more closely and to guide farmers in determining the intrinsic value when purchasing seed. The ideal cotton seed for planting is described as seed selected from cotton true to type and pure of variety; well matured; free from disease and insects or insect injury; delinted; re-cleaned and graded; and with a minimum germination of 88 per cent.

Further studies on the effect of missing hills in potato fields and on the variation in the yield of potato plants from halves of the same seed tuber, F. C. STEWART (*New York State Sta. Bul. 489 (1921)*, pp. 52, figs. 3).—In this continuation of earlier work (E. S. R., 41, p. 336), the results confirm those already reported showing that the loss due to a missing hill is partly made up by an increase in the yield of the plants adjoining the vacant space. In 1918, with a spacing of 15 by 36 in., 46.4 per cent of the loss was made up by the increased yield of the two hills adjoining the skip, and 53.8 per cent in 1919. Additional results show that the influence of single-hill and triple-hill skips upon the yield of adjoining plants is practically the same.

With 429 pairs of plants, the difference in yield of plants from similar halves of the same seed tuber grown under parallel conditions varied from 0 to 141.8 per cent of the mean yield of the two plants of the pair, the average variation being 23.4 per cent. The data indicate that a difference in number of stalks was one cause of yield variation.

This investigation "shows that in experimental work great caution should be exercised in drawing conclusions from the comparative yields of small numbers of potato plants even when the utmost care has been taken to secure parallel conditions for growth." The study "explains why the improvement of seed potatoes by selection can not be carried to a high degree of perfection. The hereditary capacity of potato plants for tuber production is so thoroughly masked by the effects of environmental factors as to make it very difficult to detect those capable of the greatest production."

Potato seed experiments: Whole small tubers v. pieces of large tubers of the same plant, F. C. STEWART (*New York State Sta. Bul. 491 (1922)*, pp. 3-30).—Experiments were made to determine the comparative seed value of whole small tubers and pieces of the same average weight cut from large tubers of the same plant. In a test in 1906, 4 rows planted with whole

small tubers of Carman No. 3 outyielded the alternating 4 rows planted with pieces of large tubers by 21.4 bu. of marketable tubers and 8.6 bu. of small tubers per acre.

In the 1920 experiment, 10 rows of 100 plants each were planted with pieces of large tubers of Enormous No. 9, while the 10 alternating rows were planted with whole small tubers of this variety. Although in the latter rows the stand was better, the early growth of the plants was more rapid, fewer were affected with leaf roll, and the yield of both large and small tubers was greater, the differences were too small to establish definitely the superiority of whole small tubers. The average number of stalks per plant was 1.91 for plants from whole small tubers and 2.14 for plants from pieces of large tubers, opposing the theory that the use of uncut tubers for seed results in a large number of stalks per plant. In both groups of plants the yield increased as the number of stalks increased, and also as the height of plants increased. The average number of tubers produced per plant was 6.57 for plants from whole small tubers and 6.39 for plants from pieces of large tubers. Rows planted with whole small tubers outyielded those planted with pieces of large tubers at the rate of about 17 bu. per acre. The crop from whole small tubers contained 1.73 per cent of small tubers, whereas the crop from pieces of large tubers had 1.58 per cent of small tubers.

For seed purposes, uncut tubers between 1 and 2 oz. in weight are held to equal and probably to excel slightly pieces of equal weight cut from large tubers of the same plant.

Do whole small potatoes make good seed? J. D. LUCKETT (*New York State Sta. Bul.* 491, pop. ed. (1922), pp. 7, fig. 1).—A popular edition of the above.

1921 potato costs, F. T. RIDDELL (*Michigan Sta. Quart. Bul.* 4 (1922), No. 3, pp. 93, 94).—Statistics collected during the 1921 summer over 732 acres in the more dense potato sections show that the direct costs on potatoes amounted to \$17.77 per acre and the overhead costs \$36.24, totalling about \$54. In caring for an acre of potatoes, 72.2 hours of man labor and 87.6 hours of horse labor were required. Yields amounted to 88 bu. of No. 1 grade and 27 bu. of No. 2, including culls.

Growing soy beans in Illinois, J. C. HACKLEMAN (*Illinois Sta. Circ.* 255 (1922), pp. 16, figs. 13).—An enumeration of the factors contributing to the great increases in the soy bean acreage in Illinois, with the details of cultural and harvesting practices found best in growing the hay and seed crops. Varieties are described and classified as to use for seed, hay, pasturing, and silage in the northern, central, and southern sections of the State.

Sunflowers, their culture and use, A. F. VASS (*Wyoming Sta. Bul.* 129 (1921), pp. 77-107, figs. 2).—A detailed chronological account of experiments with sunflowers is presented; comparative analyses of sunflower silage, corn silage, and oat and pea silage are tabulated; and discussion is given of the feeding value, varieties, yield factors, cultural and harvesting practices for silage, and the place and value of the sunflower in rotations.

The sunflower will yield twice as much silage as corn on the high altitude farms of the State with approximately the same amount of labor per ton and with the same machinery, and seeding can take place several weeks earlier. Sunflowers gave most satisfactory yields at the station when seeded at the rate of 6 to 8 lbs. per acre in rows 30 to 36 in. apart with plants 3 to 6 in. apart in the row. Sunflower silage was found to be equivalent to oat and pea silage in feeding value, and 3 lbs. of sunflower silage replaced 1 lb. of alfalfa hay. The animals receiving silage showed better gains.

The sunflower as a silage crop, H. N. VINALL (*U. S. Dept. Agr. Bul. 1045* (1922), pp. 1-19, 30-32, figs. 8).—The early history of the sunflower is related, and an account is given of its distribution and cultivation in the United States, climatic and soil requirements, cultural operations and harvesting practices involved in silage production, yields, diseases, and insect pests. Much of the information was derived from experiments by this Department and by experiment stations in the United States and Canada. Discussion of the feeding value of sunflower silage and of the sunflower as a soiling crop is noted on p. 171.

While sunflowers are widely distributed in nature and can be grown successfully in nearly every part of the United States, their value in any region depends more on the measure of success attained with other crops than on their own adaptation to local climatic conditions. The adaptation of sorghums in the central and southern Great Plains, corn in the Corn Belt, and corn, soy beans, Japanese cane, pearl millet, and other silage crops in the Southeastern States makes doubtful the popularity of sunflowers for silage in these regions. In the extreme northern part of the United States or at high altitudes in the Western States where the temperatures during the growing season are relatively low, and corn, sorghum, and other crops do not produce heavy yields for silage, the sunflower is recognized as an extremely valuable silage crop, and the acreage devoted to its production is increasing rapidly.

Scarifying Ohio sweet clover seed, C. J. WILLARD and H. L. BORST (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 3-4, p. 62).—Samples of sweet clover seed from Ohio growers, tested at the department of farm crops, Ohio State University, showed germinations ranging from 31 to 90 per cent and contents of hard seed from 1 to 43 per cent. Scarified samples germinated an average of 81 per cent and the other samples 63 per cent, while the hard seed content amounted to 7 and 24 per cent, respectively. Counts of the stand on field plats seeded on April 20 at the rate of 10 lbs. per acre showed an average of 26 plants per square foot from scarified seed and 15 plants per square foot from unscarified seed, indicating that a better stand can be secured from scarified seed than from unscarified when seeded after freezing weather is past.

Response of sweet clover to phosphatic fertilizer, F. H. BALLOU (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 3-4, pp. 68-72, figs. 3).—Sections of orchard at the Southeast Test Farm at Carpenter, formerly under cultural tests, were limed in the spring of 1920 and seeded to a mixture of grasses and legumes at the acre rate of 8 lbs. timothy, 12 lbs. red clover, and 4 lbs. each of redbud, orchard grass, sweet clover, alsike clover, and alfalfa. Similar areas were treated (1) with 200 lbs. of nitrate of soda per acre annually, (2) unfertilized, and (3) with 200 lbs. of nitrate of soda and 200 lbs. of acid phosphate per acre annually.

Close examination during the first season revealed that the grasses were somewhat more densely set and vigorous on plats 1 and 3, and in the latter a more generous and thriving admixture of legumes appeared in addition. The sweet clover became noticeable early in the summer of 1921. It was thin and irregularly distributed in plat 1, having to compete with the thick setting of fine grasses flourishing because of an abundance of nitrogen. The sweet clover in plat 2, although decidedly patchy, was generally thicker and somewhat more vigorous than that on plat 1, while plat 3 contained not only a uniformly tall, thick, heavy growth of sweet clover, covering nearly the entire surface of the ground, but also a good undergrowth of grasses, among which red and alsike clover were plentifully interspersed. When two representative tree squares were cut from each plat in July, 1921, and the sweet clover separated from the other species of plants and weighed in the uncured state, its

yields from plats 1, 2, and 3 amounted to 1,360, 3,357, and 10,739 lbs. per acre, respectively.

Experiments with Hubam clover, C. J. WILLARD and L. E. THATCHER (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 1-2, pp. 2-18, figs. 8).—Conclusions from tests including Hubam clover, by the department of farm crops at Ohio State University at Columbus and by the station at Wooster, may be summarized as follows:

In good soil following a grain crop, Hubam clover will make from 1 to 2 tons of hay per acre, but it will not greatly outyield biennial sweet clover, if at all, and the hay of the latter is of far better quality. Two cuttings may be secured if Hubam is sown alone on a prepared seed bed early in April. The first crop should be cut early in July, leaving a stubble 4 to 6 in. long, while the second cutting can be made sometime in September, depending upon the season. Much trouble with weeds may be expected if the ground is not fairly free from weed seeds. Hubam clover is as sensitive to acid soils as any other sweet clover. This variety may be sown with a nurse crop of winter wheat or rye or spring oats or barley, but the late spring crops such as Sudan grass and soy beans are not recommended. The early removal of a nurse crop is desirable, since the hay yield is increased. Eight to 10 lbs. of scarified seed per acre drilled solid or broadcast seems to be a satisfactory rate for hay production. The yield of Hubam clover varies greatly with the season, a dry summer favoring early maturity and abundant seed production at the expense of vegetative growth.

Hubam clover will make large yields of seed in the latitude of Columbus, either in rows or broadcast in a grain crop. At Wooster, best results were secured in cultivated rows 28 to 36 in. apart.

The percentage of crude protein in the Hubam hay decreased rapidly as the clover approached maturity, ranging from 18 per cent for 96 days to 12 per cent for 121 days' growing period following the removal of a nurse crop of oats at Wooster. At Columbus, Hubam clover hay made on August 29, after the removal of a nurse crop of wheat, contained 14.63 per cent of protein and the biennial white sweet clover 19.06 per cent. The percentage of nitrogen in the roots of the biennial was found to be about four times that in roots of Hubam, and the weight of the roots of the biennial to a depth of 1 ft. was seven times that of Hubam. Thirty times as much nitrogen per acre was found in the roots of biennial white sweet clover as in Hubam. "The biennial white sweet clover has such a larger and deeper root system than Hubam that there seems to be little to recommend the latter for soil improvement, unless an annual crop is required. . . . The present experimental data point to no very definite place that Hubam clover can fill in the ordinary farm rotation in Ohio."

Bee keepers have found Hubam to be a valuable nectar-secreting plant. Honeybees have been observed working Hubam clover flowers late in the fall several days after a hard frost, when many flowering plants of other species had ceased to bloom.

Hubam clover as a field crop, J. F. COX (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 75-77).—A discussion of results obtained with the variety in Michigan with cultural directions for the production of forage and seed.

Acme wheat, M. CHAMPLIN and E. MCFADDEN (*South Dakota Sta. Bul.* 194 (1921), pp. 327-355, figs. 4).—An account of the origin and characteristics of Acme wheat and its behavior in South Dakota.

Acme, a selection from Kubanka, is a bearded spring durum wheat with smooth, golden chaff and a short, plump, amber kernel. It closely resembles its parent in appearance but has slightly narrower heads and glumes, shorter,

plumper kernels, and a finer straw immediately below the head. The straw is golden in color and is slightly shorter than in the common durum varieties, but is likewise subject to lodging when grown on rich bottom lands in the more humid sections of eastern South Dakota. While Acme usually ripens about 2 days earlier than Kubanka and from 3 to 5 days earlier than Arnautka, it is not quite as early as Marquis.

At the Highmore experiment farm during the period of 1914 to 1919, inclusive, Acme averaged 22.1 bu. per acre, 4 bu. more than Kubanka S. D. 75, which with its sister strain, S. D. 73, proved to be the highest yielders in previous experiments (E. S. R., 30, p. 738). In the varietal experiments at the station from 1916 to 1919, inclusive, Acme returned an average of 1.1 bu. more per acre than Kubanka S. D. 75, its closest competitor. Averaging the yields at Highmore during the black-rust years, 1914, 1916, and 1919, shows that Acme produced 7.4 bu. more than Kubanka, the next variety and 19.8 bu. more than Bluestem. The fact that the northern Great Plains region "is seldom visited by stem rust indicates that the high yielding ability of Acme is due to other factors besides rust resistance, and must be attributed to a peculiar ability to withstand drought."

Acme is primarily a dry-land variety and is not adapted to that portion of the State lying within the 25-in. rainfall belt nor to low, poorly drained soils or exceptionally rich soils in the eastern part of the State. Neither does it appear to be well adapted to irrigation. Experiments with Acme wheat at Highmore, in progress since 1916, favor seedling as early as soil conditions are favorable. An average decrease in yield of nearly 5 bu. per acre is noted for each 15-day period from March 15 to May 15. Five pecks per acre appears to be the most economical rate.

Investigations in cooperation with the U. S. Department of Agriculture have shown Acme to be similar to Kubanka in milling quality. The flour yield has been uniformly good. The loaf volume is slightly less than that of Kubanka, but not too low to interfere with the manufacture of durum-wheat products.

Results of seed tests for 1921. M. G. EASTMAN (*New Hampshire Sta. Bul.* 202 (1921), pp. 24).—The purity and germination of 498 official samples of agricultural seed collected during the year ended July 1, 1921, are tabulated, together with the text of the law to regulate the sale of agricultural seed, effective September 1, 1921, and rules and regulations relative to its provisions and enforcement.

Nineteen noxious weeds of Indiana. A. A. HANSEN (*Indiana Sta. Circ.* 106 (1922), pp. 32, figs. 20).—Descriptions of the 19 weeds designated as noxious in the Indiana seed law, with eradication and control methods.

How to comply with Indiana seed law. E. G. PROULX (*Indiana Sta. Circ.* 105 (1922), pp. 8, figs. 4).—The important features of the law are discussed, with information on exemptions and the labeling, testing, and sampling of agricultural seeds.

HORTICULTURE.

[Report of the] department of horticulture (*Indiana Sta. Rpt.* 1921, pp. 25-28, figs. 2).—Without including data, brief comments are given on the progress (E. S. R., 45, p. 133) of various investigational activities.

The records of the tenth year of the soil management studies in the apple orchard at Laurel, Ind., confirm the results obtained in previous years, namely, that the trees under cultivation with cover crops and those under the straw-mulch method of management are much more productive than the trees in sod.

Production records taken in 1920 on trees included in the pruning experiment at Laurel indicated that heavy pruning curtailed the yield of fruit, in

that lightly pruned trees produced twice as much fruit as heavily pruned trees. Since no pruning had been performed on any of these trees since 1918, the results also indicated that the detrimental effect of severe pruning is long continued. The inhibiting effect of severe top pruning on root development is illustrated by a photograph showing the much greater development of the roots of a lightly than of a heavily pruned tree.

In contradiction to the results obtained in previous years, dust was effective in controlling scab at Peru, Ind. This success is believed to be due to the comparatively light infection occurring during the year. Dusting proved to be twice as expensive as spraying.

The value of nitrogen for fruit trees is shown by results obtained at Mitchell and Bedford, where trees fertilized with nitrate of soda and ammonium sulphate produced approximately three times as much fruit as check trees.

The home vegetable garden, R. A. MCGINTY (*Colorado Sta. Bul.* 276 (1922), pp. 3-36, figs. 6).—This revision of an earlier bulletin (E. S. R., 39, p. 344) presents in a like manner practical information relative to the propagation, culture, harvesting, and storing of vegetables under Colorado conditions.

The production of peas for canning, C. J. HUNN (*U. S. Dept. Agr., Farmers' Bul.* 1255 (1922), pp. 24, figs. 8).—This publication, designed for the purpose of presenting practical information to the grower of peas for the canning factory, emphasizes improved cultural and harvesting practices. Among the subjects discussed are crop rotations, soils and their preparation, fertilizers, seed and seed inoculation, harvesting, insect and disease pests, and the utilization of the vines for feeding and as manure.

Seed peas for the canner, D. N. SHOEMAKER (*U. S. Dept. Agr., Farmers' Bul.* 1253 (1922), pp. 16, figs. 4).—While presenting general information relative to the production of seed peas for the canning industry, this publication emphasizes the difficulty confronting the growers in maintaining seed stocks free from mixed and variable types. Subsequent to a brief statement relative to the development of seed-pea growing in the United States, the author discusses varieties, describes the desirable characters in canning peas, and outlines the practices employed by professional growers in maintaining pure stocks.

Particular attention is devoted to the rogues, or off-type plants, occurring in the Alaska, a variety said to comprise 55 per cent of the total canning pea crop. These rogues, usually larger, later, and more productive than the true variety, cause considerable loss on account of their variation in time of maturity from the true type, and also because they often yield peas which when canned present an unattractive dark-colored product. The true and spurious types of Alaska are described in detail.

Canning factory tomatoes, H. D. BROWN (*Indiana Sta. Bul.* 259 (1922), pp. 20, figs. 8).—Constructive information is presented in this paper relative to improved practices in tomato growing. Data obtained from an analysis of questionnaires sent out in 1919 to practical growers indicated that the yield of wheat following tomatoes was greater than that of wheat following wheat, corn, or clover. Tomatoes proved equally adapted to either light or heavy soils providing that proper attention was paid to drainage, food, and moisture conditions. Emphasizing the fact that well-grown plants though considerably more expensive have proved more profitable than poorly grown plants (E. S. R., 29, p. 434), detailed instructions are given for the construction and management of frames suitable for plant production on a large scale. Preparation of soil, setting of the plants, and cultural practices are discussed.

Based on the results of fertilizer tests conducted in different parts of the State, the data of which are presented in tabular form, an application of from

500 to 1,000 lbs. per acre of a 2-12-6 fertilizer is recommended for general use on Indiana soils. Tests with lime applied with and without acid phosphate at two different Indiana points in 1918 showed that lime in itself exerts no direct influence on the tomato crop. Its use, however, is warranted on account of the residual effect on other members of the rotation. In general, the fertilizer tests indicated that acid phosphate is the most important ingredient for tomato fertilization, not only increasing yields but also promoting the early maturity of the fruit.

Experiments in dusting v. spraying on apples and peaches in Connecticut in 1921, W. E. BRITTON, M. P. ZAPPE, and E. M. STODDARD (*Connecticut State Sta. Bul.* 235 (1922), pp. 207-226, pls. 6, figs. 5).—Experiments conducted in four apple and two peach orchards in Connecticut in 1921, with the object of comparing dusts with sprays as a means of protecting fruit trees from various insect and fungus pests indicated in general that under Connecticut conditions sprays are more effective for apples than dusts, while, on the other hand, dust gave better results with peaches. The cost of dusting computed on the basis of current prices was found to be approximately three times that of spraying.

No particular differences were observed in the value of three different dusts, sulphur, nicotine, and Sanders, applied to 17-year-old apple trees of five different varieties. In a test on 45-year-old trees, dry lime sulphur proved superior, as indicated by the number of good fruits, to commercial lime sulphur, B. T. S., and Bordeaux mixture as a material for the preparation of sprays.

The work with peaches in a 10-year-old orchard of five varieties at Mount Carmel and in a Carman and Elberta orchard of similar age at Cheshire showed plainly that dusts were more effective than sprays for controlling brown rot and scab. The dusting of peaches is, however, not deemed practicable except in large commercial orchards where sufficient time can be saved to make an appreciable reduction in labor cost.

In addition to the experimental data contained in the bulletin, many of the more important insect and fungus pests of the peach and apple are described and illustrated. A large part of the data relative to the results of the tests is given in tabular form.

[**Spray calendars for New Jersey fruits**], T. J. HEADLEE, M. T. COOK, and A. J. FARLEY (*New Jersey Stas. Circs.* 132 (1922), pp. 4, figs. 3; 133 (1922), pp. 4, figs. 3; 134 (1922), pp. 4, figs. 3; 135 (1922), pp. 3, figs. 2; 136 (1922), pp. 3, fig. 1).—A series of spray calendars for the apple and quince, peach, pear, cherry, and grape, and with the exception of that on grape spraying designed to supersede similar earlier pamphlets (E. S. R., 43, p. 37).

Spraying programs for the orchard and fruit garden (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 1-2, pp. 19-38).—Following a discussion of and directions for the preparation of important fungicidal and insecticidal spray mixtures, programs are presented for various fruits, including the apple, pear and quince, peach, plum, cherry, grape, and various small fruits.

Orchard spraying in 1922, A. FRANK (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1922), No. 7, pp. 104-106).—This is a condensed spray calendar for tree fruits in western Washington.

Analyses of materials sold as insecticides and fungicides during 1921, C. S. CATHCART and R. L. WILLIS (*New Jersey Stas. Bul.* 357 (1921), pp. 5-22).—In a similar manner to the report of the preceding year (E. S. R., 44, p. 440), results are presented of analyses of various insecticidal and fungicidal materials sold in New Jersey during 1921.

Michigan tree fruit varieties, C. P. HALLIGAN (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, p. 91).—This brief report contains lists of apple, pear, and

peach varieties deemed sufficiently worthy of planting to be recommended for use in Michigan.

[**Fruit growing in western Washington**], J. L. STAHL (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1922), No. 7, pp. 102-104, 123, 124).—This comprises two short papers, one presenting brief instructions for the establishment and maintenance of strawberry plantations and the other containing tabulated lists of fruits which are recommended as worthy of planting in western Washington.

Notes on five-year results of apple pruning, C. W. ELLENWOOD (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 3-4, pp. 58-61).—Yield records for the five years 1917-1921 of plats representing seven different pruning treatments in a commercial apple orchard near Wooster, Ohio, indicated the superiority of moderate annual pruning. The orchard in which the investigation was conducted was planted in 1907, and at the commencement of the test had already begun to bear regularly. Each of the seven experimental plats contained eight Gano and two Grimes trees.

The total yields for the entire 5 year period were as follows: No pruning, 6,515.2 lbs.; light dormant pruning, 6,988 lbs.; heavy dormant pruning, 5,034.2 lbs.; light summer pruning, 5,688.2 lbs.; heavy summer pruning, 4,605.9 lbs.; light dormant thinning and light heading back in summer, 5,581.3 lbs.; and heavy dormant thinning and heading back in summer, 3,446.1 lbs. Although the highest percentage of first grade fruit was obtained on plat 7, this was correlated with the lowest yield.

Certain responses of apple trees to nitrogen applications of different kinds and at different seasons, H. D. HOOKER, JR. (*Missouri Sta. Research Bul.* 50 (1922), pp. 3-18).—In continuing studies (E S R., 45, p. 123) upon the influence of fertilizers upon the apple tree, the author presents in this paper data relative to the effect of three different nitrogenous fertilizers applied at different seasons, as evidenced by variations in the chemical composition of spurs and of bark from the scaffold limbs.

The application on March 19, 1920, of equivalent amounts of sodium nitrate, ammonium sulphate, and dried blood to York trees in their fruiting year resulted in sharp increases in yield, each of the three materials showing practically the same value in this respect. As determined by actual count, approximately 32 per cent of the blossoming spurs of the fertilized trees bore fruit, as compared with 23.7 per cent for the check trees. A tabulation of the results of analyses of spurs and bark collected on May 22, June 19, September 6, and November 20, 1920, and April 2, 1921, from the several plats shows a temporary increase in the nitrogen content of spurs gathered May 22, which increase is believed to be associated with the greater set of fruits. Except for this temporary rise in nitrogen content, no significant differences were noted in the composition of samples from fertilized and unfertilized trees. Analyses of material collected on April 2, 1921, indicated no appreciable increase in nitrogen content due to fertilizers. Furthermore, nitrogenous fertilizers applied on March 19 did not increase the number of leaves during the current season and had little effect on the rate of growth. Since no accumulation of starch occurred in the spurs during the period of fruit bud differentiation, it is concluded that the spring application of nitrogenous fertilizers also has no effect in this respect.

Ben Davis and Jonathan trees, 3 years old in 1920, treated with 3 lbs. of sodium nitrate in the spring of 1919 and again in 1920 were observed to be conspicuously larger than the untreated trees. Since analyses of spurs collected from these trees on March 29, 1920, showed a lower percentage nitrogen content for spurs from fertilized than from check trees, it is evident that the

previous year's application of sodium nitrate had no effect upon the nitrogen content. Similarly, the nitrogen content of fertilized spurs collected June 19 was less than that of the check trees, but at the same time the starch content was also distinctly less, which findings are held to indicate that conditions for fruit bud differentiation were rendered less favorable by spring applications of nitrogenous fertilizers. The reduction in starch is believed to be correlated with the vigorous growth development of the trees. The consistently lower potassium and total ash and usually lower phosphoric acid content of the spurs of fertilized trees is also thought to be closely associated with increased growth. The evident correlation between increase in length of spurs and decrease in ash, phosphorous, and nitrogen content is indicated in a table showing the results of analyses of Ben Davis spurs gathered May 21 and July 2 and grouped into four length classes, namely, 0.5 to 1, 1.1 to 1.5, 1.6 to 3, and 3.1 to 10 cm.

A number of spurlike and leader growths were carefully labeled and measured on two 10 tree plats in a vigorous 4-year-old Grimes orchard at Turner Station, Mo. One plat had been treated with 2 lbs. of sodium nitrate and the other with 2 lbs. of dried blood per tree on March 29, 1920. Measurements taken later in the season showed that the sodium nitrate was more potent than dried blood in stimulating shoot growth. However, no significant differences were observed in spur growth. Chemical studies of the same types of growths from the respective plats showed no marked differences in relation to treatment. Notable variations were found within the individual tree, since in June, when starch had completely disappeared from the spurlike growths, the nitrogen content had reached a maximum.

In order to test the effect of variation in time of application of fertilizers, three 15 tree plats of 16-year-old York trees in their nonbearing year were treated as follows: Plat 1, 5 lbs. of dried blood per tree on March 29, plat 2, same application on June 20, and plat 3, 5 lbs. of sodium nitrate on September 20. The differential effects of applying these fertilizers at various seasons was most evident in the nitrogen content of the spurs. Analytical data on material collected March 30, 1921, showed that spurs from the plat nitrated on September 20 had much the higher nitrogen content, indicating that the later in the season nitrogenous fertilizers are applied the greater is the nitrogen content of the spurs in the succeeding spring immediately prior to growth renewal. The residual effect of spring applications of fertilizers was, on the other hand, practically nothing.

In summation, the author emphasizes the fact that the investigations indicate the necessity of more intelligent use of nitrogenous fertilizers. It is pointed out that an application highly effective in one instance may be entirely useless and even harmful in another. As a particular example it is explained how a heavy application of nitrogen in the spring of the bearing year to biennially fruiting apple trees of normal vigor may very well lead to disastrous overproduction.

Fertilizer trials with apples, R. E. MARSHALL. (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 87-90, figs. 3).—This is a brief report of a fertilizer test with apples initiated in the spring of 1920 in a neglected 35-year-old Ben Davis orchard located near Eaton Rapids, Mich. The poor condition of the trees in the orchard at the beginning of the experiment was manifested by the presence of many dead and weak branches and by poor yields of fruit. Although fertilizers were applied both in the spring of 1920 and 1921, the yields of the first season were too insignificant to warrant the taking of records. Bloom in 1921 was abundant and evenly distributed throughout the orchard; however, the

set of fruit was considerably reduced by severe late frost. Six different fertilizer treatments were compared, namely, (1) sodium nitrate, (2) ammonium sulphate, (3) none, (4) acid phosphate, (5) complete fertilizer, and (6) sulphate of ammonia and acid phosphate (one year only). The results, expressed in tabular and graphic form, indicate the superior value of the complete fertilizer, the yields in pounds per tree from this treatment being somewhat over six times that on the control plot. Nitrate of soda, ammonium sulphate, and acid phosphate proved practically equally effective in promoting yield. The larger fruits were harvested on the nitrogen plots and the best colored on the phosphate and check areas.

Incidental to the main test, the value of limestone for apple orchards was determined, the results showing no appreciable benefit from applications of 2 tons per acre in 1920.

Lessons from 1921 orchard work, F. H. BALLOU (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 3-4, pp. 63-67).—In a review of the disastrous fruit year of 1921, the author points out certain outstanding features. Those orchards, especially in south-central Ohio, which were not sprayed during the season following the destruction of the crop by early spring freezes, suffered from the depredation of foliage attacking fungi, which in some instances were sufficiently abundant to cause entire defoliation with consequent severe injury to the fruit buds destined to form the 1922 crop. Observations showed that those trees which were well nourished by early spring applications of available nitrogenous fertilizers possessed greater resistance to freezes than did unfertilized trees, which fact is believed to explain the existence of scattering orchards producing partial and in some cases full crops of fruit. Notable differences were also observed in the comparative frost resistance of varieties. For example, wherever Rome Beauty and Jonathan occurred in orchards of mixed varieties where some fruit was set, these two kinds were uniformly among those bearing.

A new feature of bud variation in citrus, T. TANAKA (*U. S. Dept. Agr., Dept. Circ.* 206 (1922), pp. 8).—A brief report of a study of the Satsuma orange in Japan, particularly of a variety known as Wase, which is believed to have originated as a bud variation of the Owari variety some 30 years ago.

Careful inspection resulted in the discovery of seven separate instances of sporting branches on Owari trees, each of which bore fruit identical to Wase, leading the author to conclude that Wase undoubtedly originated in a like manner. These bud variations were found to be relatively rare, in that only one such mutation was discovered in an examination of approximately 100,000 trees. The importance of such variations is emphasized by the fact that the Wase orange industry of Japan amounts to \$75,000 per annum.

The frequent occurrence of Owari trees in orchards of the Wase variety is accounted for by reversion, and this supposition is supported by the discovery in 1920 of numerous Wase trees bearing sporting branches of the Owari type. Instances of foliar variation in the Satsuma are cited to further illustrate that mutation within this species is not an unusual occurrence. Following a brief discussion of the physiology of bud variation is a bibliography consisting of 23 titles.

Olive growing in the southwestern United States, C. F. KINMAN (*U. S. Dept. Agr., Farmers' Bul.* 1249 (1922), pp. 43, figs. 28).—A compilation of information relative to olive production in the United States, including data concerning the history of the industry, distribution of orchards, climatic and soil requisites, varieties, propagation, top-working of old trees, planting, cultivation, irrigation, fertilization, pruning, harvesting, control of insect and fungus enemies, and grading and processing of the fruits.

A study of the influence of physical soil factors and of various fertilizer chemicals on the growth of the carnation plant, F. R. PEMBER and G. E. ADAMS (*Rhode Island Sta. Bul.* 187 (1921), pp. 5-94, figs. 6).—This comprehensive paper, prepared in two parts, deals with various phases of an investigation commenced in 1907, relative to soil management in carnation forcing houses.

Part 1, by Pember and Adams (pp. 5-31), considers means of maintaining fertility and productivity without actual replacement of soil. Several different varieties of carnations were grown during the 6 years' duration of the treatment but were so distributed with respect to various treatments as to have no disturbing influences on the results. The records of yield and grade of blossoms from the various plats, given in tabular form, indicate that the addition of stable manure to a Miami silt loam during the period of 6 years was more effective in increasing the yield of blooms than were chemical fertilizers alone or supplemented with sphagnum moss, finely cut clover, or finely cut alfalfa. The average increase of grade 1 and 2 blooms per plant for the manure plats for the entire 6-year period was 2.6 above that of the lowest producing plat, namely, the chemical fertilizer section. However, when sphagnum moss was added to the chemical fertilizer the increase was less than one bloom per plant for the period. The average number of blooms produced in the six months October to March during the 6 years was about 40 per cent of the total production in the nine months' producing season. The keeping quality of flowers was not materially affected by the kind of soil treatment. The percentage of split calyxes varied considerably among the different varieties, as well as from season to season. Grouping the varieties as a whole, the lowest percentage of split blooms for the 6 years was obtained from the bone sections, with acid phosphate second, and acid fertilizer third, while the highest percentage was obtained from the manure plats.

The second part of the report, by Pember (pp. 31-94), deals mainly with the nutrient requirements of the carnation and with the effect of different forms and amount of nutrient materials upon plant growth. As in part 1, much of the data, including analyses of carnation plants growing under different nutrient conditions, is presented in tabular form.

The use of the same soil plus manure for 5 years reduced the yield of grade 1 and 2 blooms by an average of about 5 per cent below that obtained by the use of fresh soil and manure. The addition of chemicals to soil and manure compost slightly increased production of blooms during the first year, especially when only a small amount of chemical nitrogen was applied. When used with soil and manure during the second year, nitrogen and potassium oxid at the rate of 1,000 lbs. each per acre proved toxic. Less split calyxes in grades 1 and 2 were recorded following the addition of large amounts of nitrogen, notwithstanding the inhibiting effect on the plant and on the number of blooms.

A relatively high proportion of phosphorus in chemical fertilizers used for supplementing animal manure or as a sole source of plant food proved advantageous in stimulating yield. An application of 5.5 tons of limestone per acre to soil and manure plats in the 1916-17 season had no marked effect upon plant growth. Ferrous sulphate added at the rate of 1,300 lbs. per acre to the limed soil decreased flower production. Nitrate of lime and sulphate of ammonia had practically the same effect on yield of grade 1 and 2 blossoms. Finely cut rye straw proved superior to green soy beans in respect to yield of grades 1 and 2. Soil moisture content had no noticeable effect upon production or character of blooms.

In many instances as good yields were obtained from sand treated with chemical fertilizers as from soil and manure or soil, manure, and chemicals. Six tons of acid phosphate when used in connection with abundant applications of nitrogen proved beneficial to plants growing in sand. Potassium also proved of value when accompanying excessive applications of nitrogen and phosphorus. Pointing out the usual lack of phosphorus in soils and in stable manure, the author recommends the addition of this element to soil composts, and, if applied in the form of acid phosphate, it is suggested that 1 ton per acre will generally give profitable returns. Where the use of a complete fertilizer is deemed necessary a formula of 4-10-4 is considered satisfactory.

The performance of plants placed in permanent position in the greenhouse about the middle of July and of those planted about the fourth week of August was not markedly different.

Trees for town and city streets. F. L. MULFORD (*U. S. Dept. Agr., Farmers' Bul.* 1208 (1921), pp. 40, figs. 27).—The subject matter contained in this and in the recently noted companion bulletin (E. S. R., 46, p. 41) appeared in a previously noted paper by the same author (E. S. R., 42, p. 538).

FORESTRY.

Storage of coniferous tree seed. C. R. TILLOTSON (*Jour. Agr. Research* [U. S.], 22 (1921), No. 9, pp. 479-510, figs. 2).—For the purpose of procuring data relative to the best localities for and the best conditions under which to store forest tree seeds, that of six species of American trees, namely, *Picea engelmanni*, *Pinus monticola*, *P. contorta*, *P. ponderosa*, *P. strobus*, and *Pseudotsuga taxifolia*, collected in the fall and winter of 1908-09, after thorough mixing, cleaning, and drying was divided into 13 lots, placed in five different types of containers and shipped to different points in the United States for storage. In order to make the test comprehensive, each lot was again divided, one-third being exposed to ordinary indoor temperature, another to fluctuating temperature as in an outbuilding or unheated garret, and still another stored in an ordinary unheated house cellar or basement.

Of the five types of containers used in the test, namely, (1) manila paper coin envelopes, (2) same soaked in paraffin, (3) cotton bags, (4) same soaked in boiled linseed oil and then dried, and (5) glass bottles sealed air-tight with paraffin, the last named proved far superior in every respect. The average germination for the initial 5-year period of seed from the bottles exceeded that of the next best container, the paraffin paper sack, by 22 per cent. The oiled cloth bag proved practically worthless for storage purposes. Seed in glass jars was little if any affected by geographical location or by local differences in temperature due to the buildings in which they were placed, and was not subject to the rapid deterioration which after two or three years rendered the other lots of seeds of practically no value. Of the three temperatures compared at each locality, that of the indoor heated building proved the most satisfactory. The importance of geographical location in the preservation of forest tree seeds was shown by the higher germination of seed stored at certain localities, conspicuously those situations combining high altitude with low relative humidity. In respect to viability, the species, grouped in order of strength, were *Pinus ponderosa*, *P. contorta*, *P. monticola*, *P. strobus*, *Picea engelmanni*, and *Pseudotsuga taxifolia*.

Algaroba seed germination tests. C. S. JUDD (*Hawaii. Forester and Agr.*, 17 (1920), No. 12, pp. 342-344).—In order to test the effect of passage through the alimentary system of a horse on the germination of algaroba (*Prosopis juliflora*), six different sets of seeds of 100 each, namely, (1) naked seed un-

treated, (2) naked seed placed in boiling water and soaked for 24 hours, (3) seed in parchment covering, untreated, (4) same but placed in boiling water and soaked for 24 hours, (5) naked seed which had passed through the alimentary system of a horse, parchment covering removed, and (6) same as (5) without the removal of the covering, were compared in respect to germination. The test, started on December 20 and continued until April 16 of the following year, at which time germination was complete, showed the highest percentage of viability (87 per cent) in the case of naked seeds not treated in any manner. The seeds which had passed through the horse and then removed from their parchment coverings germinated more quickly than untreated naked seeds, but the germination was less. The hot water treatment greatly accelerated the germination of seeds, and in the case of the naked seeds 80 per cent germinated within the first seven days.

A progress report of the results secured in treating pure white pine stands on experimental plats at Keene, N. H., R. C. HAWLEY (*Yale Univ. School Forestry Bul.* 7 (1922), pp. 33, fig. 1).—The silvicultural studies with white pine reported in this paper were begun in 1905 by the U. S. D. A. Forest Service in cooperation with the owners of a tract of forest land located near Keene, with the object of determining the value of different methods of thinning and of the practicability of the shelterwood method of reproduction. The plats were established on a fine, deep, sandy soil inclined to drought in summer, which fact is believed to account for the lack of any bitter competition with hardwood species. In 1915, after the completion of a second series of measurements, the plats were placed under the control of the Yale School of Forestry, under whose guidance the work is being conducted at the present time.

Three types of thinning, namely, ordinary B, ordinary C, and Borggreve's, were compared with one another and with no thinning. The decrease in the number of trees during the 15-year period caused by thinning operations and natural losses was 67 per cent for the B treatment, 74 for the C treatment, 77 for the Borggreve method, and 28 per cent for the unthinned plat. Records of growth show that the annual increase was greater on the thinned plats than on the control. Of the three types of thinning under observation, C grade proved most satisfactory, as indicated by the appearance of the stand and character and spacing of the trees. From an economic point of view, the sale of material obtained in thinning operations materially reduced the cost per acre of growing the timber.

The results of the studies in reproduction, also given in tabular form, led the author to conclude that white pine renewal can be successfully obtained by cuttings under the shelterwood method. One or more disengagement cuttings are believed necessary for the subjection of competing hardwoods, more particularly on moist and heavy soils favoring the development of the latter type. The slash left after thinning, although not materially interfering with reproduction, caused a reduction in the amount of stand on small areas.

The station's white pine plantation, A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 105, 106).—The study of measurements taken in 1916 and 1921 in the 3.5-acre plantation of white pine established at the Michigan College in 1896 showed a volume increase of 12.8 cords, or 6,379 board feet, per acre for the five-year period.

Emphasizing the value of white pine as an economic crop, the author advises that on account of blister rust this species should not be planted in the Michigan counties enumerated, which produce currants and gooseberries. Red pine, Norway spruce, white ash, and black walnut are recommended as desirable substitute species.

The weeping hemlock, H. S. NEWINS (*Jour. Forestry*, 20 (1922), No. 3, pp. 272-275).—A brief note, including descriptive data, recording the discovery of a pendulous form of western hemlock (*Tsuga heterophylla*) about 20 miles west of Corvallis, Oreg.

Woodlot or sugar bush? P. L. BUTTRICK (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 107, 108, fig. 1).—The author, directing attention to the possibility of managing the farm woodlot so that it will permanently produce both trees for sugar production and trees for fuel, shows how this may be brought about by allowing beech and other compatible species to develop as an understory growth and later removing the smaller trees before they attain a sufficient size to compete disastrously with the maple.

Government forest work (U. S. Dept. Agr., Dept. Circ. 211 [1922], pp. 47, figs. 11).—A small pocket guide outlining and discussing in a popular way the activities and purposes of the U. S. D. A. Forest Service, especially in relation to the management of the National Forests.

DISEASES OF PLANTS.

[Report for 1921 of the] department of botany (*Indiana Sta. Rpt. 1921*, pp. 14-19, figs. 2).—Investigations on the leaf rust of wheat, it is claimed, show that the acial stage has been produced on *Thalictrum* from a large number of collections of the wheat rust. There is evidence of at least six biologic forms of this rust occurring on wheat.

Some physiological experiments were carried on for the purpose of determining the definite effects of various salts of iron and aluminum on corn plants. The results are held to show that aluminum and ferrous-iron ions are very injurious, and that it is necessary to maintain conditions in the soil which will keep them unavailable for absorption by the plants. The characteristic effects of salts of these metals on corn plants are shown in the production of streaking and intervascular tissue necrosis of the leaves, and a discoloration and disintegration of the vascular plate tissues in the nodes of the stalk. Salts of iron and aluminum are said to be available in many acid soils, and it is believed that the severity of the root rots may be lessened by the correction of available salt supply to the plants. This has been accomplished by the use of soluble phosphates added to the soils both in greenhouse and field tests.

Studies were made on the mode of overwintering of the mosaic disease of tomatoes, and no evidence of seed transmission was obtained. Field observations, however, have shown that under Indiana conditions many weeds are a source of mosaic infection for the tomato crop. Among the species which are a source of danger are the horse nettle (*Solanum carolinense*), several species of ground cherries, among them *Physalis heterophylla*, *P. subglabrata*, and *P. virginiana*.

Evidence has been obtained which indicates that the soy bean bacterial spot is transmitted by the seed, and studies of the apple blotch revealed that 90 per cent of the twig infection of the Northwestern Greenings occurs at the leaf scars.

Report of the microbiologist, 1920 [Jamaica], S. F. ASHBY (*Jamaica Dept. Agr. Ann. Rpt. 1920*, pp. 24, 25).—Banana wilt (Panama disease) apparently continues under reasonable control. New infections noted appeared to be due to transmission of the disease in banana trash.

Coconut bud rot was restricted as to incidence by the drought of the previous year, although a few cases were observed. Leaf bite, conspicuous in the north-eastern parishes during and after the hurricane years 1915-1917, ceased to be

epidemic, many trees throwing off the disease. Die-back has again shown increase, the droughts of 1919-20 appearing to stand in causal relation thereto. The abundant dead or diseased roots yield a *Pythium* and a *Rhizoctonia*, both of which are stated to have been found in association with diseased roots of other plants elsewhere.

Sugar-cane mosaic (mottling, yellow stripe) disease has received much attention since its recognition last year as present locally. This disease is said to have caused serious reduction of tonnage. Uba (Kavangire) cane appears to be immune locally. Seed-piece selection and especially roguing out of affected plants, adopted by many planters, promise good results.

[**Phytopathological studies**] (*R. Staz. Patol. Veg., Rome, Bol. Mens., 1* (1920), No. 1-2, pp. 24-28).—Researches recently completed or still in progress at the station for plant pathology, Rome, are briefly discussed as regards results and bearings.

The organization of the phytopathological service in Italy, G. B. TRAVERSO (*R. Staz. Patol. Veg., Rome, Bol. Mens., 1* (1920), No. 1-2, pp. 7-16).—A brief history is given of early and more recent activities connected with the recognition and control of plant diseases in Italy. Twenty-two regional phytopathological observatories are named with their locations.

A list of fungi (Ustilaginales and Uredinales) prepared for exchange, F. W. PATTERSON, W. W. DIEHL, and E. K. CASH (*U. S. Dept. Agr., Dept. Circ. 195* (1922), pp. 50).—A list of material from nearly 1,000 collections is given, and the conditions are stated under which exchanges can be made.

The wheat bunt problem in Oregon, D. E. STEPHENS and H. M. WOOLMAN (*Oregon Sta. Bul. 188* (1922), pp. 5-42, figs. 5).—Both *Tilletia tritici* and *T. levis* are said to occur in the Willamette Valley, Oregon, but only *T. tritici* is found in the eastern part of the State. Seed-borne spores are said to be a common method of infection, but investigations conducted in the summer of 1918 indicate that wind-borne spores cause the principal part of the infection in the eastern part of the State.

Previous investigations having shown that under certain conditions seed treatment resulted in injury, the authors carried on experiments testing formaldehyde and copper sulphate solutions, and it was found that at sufficient strength to kill the smut under certain conditions, germination was delayed or destroyed and the vigor of the young plants seriously impaired. Further experiments show that seed treated with formaldehyde should be sown as soon as possible after treatment, or while the seed is still damp, and only in moist soil. The copper sulphate treatment is preferred if the seed is to be stored for any length of time or if it is to be sown in dry soil.

Studies were made of the relative resistance of varieties of wheat to smut, and a number of pure line selections were discovered that are totally immune to both species of stinking smut. About 20 varieties were found so highly resistant to the disease that they can be safely sown without treatment for bunt.

A bacterial wilt of the bean caused by *Bacterium flaccumfaciens*, F. HEDGES (*Science, n. ser., 55* (1922), No. 1425, pp. 433, 434).—The author describes a bacterial disease of Lima beans that was observed in 1920 in South Dakota, where it is said to have destroyed 90 per cent of the crop. Seed produced by the remaining crop when planted in South Dakota and at Arlington, Va., reproduced the disease. The disease in question is characterized by a wilting of the leaves of seedlings sometimes accompanied by discoloration, and by dwarfing, reduction of yield, and the death of some of the shoots if the plants survive the early stages of growth.

The author isolated a yellow organism from the affected material and reproduced the disease in her inoculation experiments. The differentiating

characters of this organism and *B. phaseoli* are described at length. The organism is described under the name *B. flaccumfaciens* n. sp.

Seed treatment and rainfall in relation to the control of cabbage blackleg, J. C. WALKER (*U. S. Dept. Agr. Bul. 1029 (1922), pp. 27, pls. 2, fig. 1*).—In a previous publication (*E. S. R.*, 40, p. 846), the treatment of cabbage seed with formaldehyde or corrosive sublimate solutions was recommended for the control of blackleg due to *Phoma lingam*. Later, seed that had been treated according to directions was planted in Wisconsin and blackleg developed to such an extent that a heavy crop loss was experienced. This led to studies to determine the limitations of seed treatment and also the relation of certain environmental factors to the development and spread of the disease, especially in the seed bed.

The dissemination of the fungus in the seed bed or during transplanting is considered of much greater importance than its spread in the main field. The occurrence of the disease in an epiphytotic form is usually associated with the use of infected seed, and treatments with formaldehyde, corrosive sublimate, hot water, and dry heat, while reducing the amount of the disease, do not entirely exterminate it. When infected seed is used a small percentage of seedlings show lesions within 10 days or more, and by spattering water and proper conditions of atmospheric humidity, the disease spreads to surrounding plants. In 1918, seed treated with formaldehyde solution and planted resulted under favorable weather conditions in a severe form of the disease. In 1919, under dry weather conditions, treating seed with corrosive sublimate, followed by rinsing in clean water, quite successfully controlled the disease. Where frequent rainy periods prevailed, the disease developed to a severe extent.

The author calls attention to the limitations to success in the control of blackleg, and suggests the use of seed produced in regions where blackleg does not prevail.

The Sclerotinia rot of celery, R. F. POOLE (*New Jersey Stas. Bul. 359 (1922), pp. 5–27, figs. 15*).—According to the author, a disease of celery due to *S. libertiana* is common and destructive in greenhouses in the muck bog areas of New Jersey and elsewhere, attacking plants growing on other types of soil. Although the disease is most destructive in seed beds, it is also said to occur in fields, though it does not cause very serious losses in the open field.

The author has conducted investigations on this rot of celery since 1917, and gives the results of his studies. The fungus was found to cause a rot of young celery plants, particularly in greenhouses, and it also attacks lettuce in various types of soil throughout the State. *S. minor*, which has been reported elsewhere as causing a rot of celery, has not been observed to do so in New Jersey.

For the control of this disease the author recommends the replacing of infected soils with virgin soils or the sterilization of the soil in the greenhouse with formaldehyde. As a considerable number of other plants are known to be infected with this organism, they should not be grown in rotation with celery.

Potato disease investigations, J. E. KOTILA (*Michigan Sta. Spec. Bul. 110 (1921), pp. 27–33, figs. 5*).—The principal investigations reported upon are potato-seed treatments and studies of potato blackleg and hopperburn or tipburn blight.

Seed-treatment experiments were carried on in 1919 and 1920, both at the station at East Lansing and at the substation at Chatham. In 1919 the treatments were all made at East Lansing and half the seed sent to Chatham for planting, while in 1920 the procedure was reversed. The tubers were treated with corrosive sublimate, mercuric cyanid, and formaldehyde, different lengths of treatment being tested. Although the experiments at each place were iden-

tical, the results obtained in the two seasons were not comparable. Excellent control for *Rhizoctonia* and scab was obtained at East Lansing by corrosive sublimate treatment for 30 minutes, while treatment with formaldehyde for the same length of time controlled scab but was not effective for the control of *Rhizoctonia*. Good control was obtained at Chatham with corrosive sublimate with both the 30-minute and 1.5-hour treatments, but the control was not as complete as at East Lansing. The longer treatment gave better results at Chatham in 1920 than the shorter treatment, while in 1919 the 30-minute treatment was as effective as the longer time of application. At East Lansing the short treatment during both years was found to be as effective as the long-time treatment.

In a previous publication (E. S. R., 45, p. 650) attention was called to the relation of limestone in the soil to potato scab control. In the present report an account is given of experiments carried on in 1919 and 1920, high percentages of scab being found in all plats regardless of tuber treatment. This is attributed to the alkalinity or neutrality of the soils due to limestone. Sulphur was used in 1920 to see whether it would produce an acid condition of the soil and thus prohibit the growth of the scab organism. At harvest the yields did not show any appreciable decrease in the percentage of scab, but it is thought that the change in soil reaction was not brought about quickly enough and that the young tubers had become spotted before the change in soil reaction had taken place.

Notes are given on blackleg, said to be one of the most important potato troubles in the Upper Peninsula district of Michigan. It is claimed that this disease can be controlled by treating the seed tubers with corrosive sublimate, and by roguing out diseased hills during the growing season.

Investigations on hopperburn or tipburn blight are reported on page 158.

Potato leaf roll, E. BLANCHARD and C. PERRET (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 294-303).—Studies in continuation of those previously noted (E. S. R., 46, p. 44) are outlined, with results and conclusions in general confirmatory of those already announced.

Disinfection was without effect, as was long rotation. The trouble appears to be physiological in its origin, perhaps due to some fault of nutrition inherent in the tuber (stock), though intensified by other factors named.

Suggestions of a practical character refer to the adaptation of fertilizers, the methodical renewal of seed stocks, and the development of new varieties.

Potato leaf roll, E. BLANCHARD and C. PERRET (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), Nos. 1, pp. 20-22; 2, pp. 45-48; 3, pp. 70-72).—A review and résumé of studies on potato leaf roll from 1914 to 1920 (see above) concludes with the general statement that potato leaf roll appears more and more to be the outward manifestation of an alimentary trouble not greatly differing, as regards characters, from disorders appearing in other plants under similar circumstances. The principal cause of the trouble appears to be the insufficiency of nitrogen, the chief characters resembling those attendant upon the condition of nitrogen starvation, which here appears to be in a degree hereditary.

Potato scab and methods for its control, W. H. MARTIN (*New Jersey Stas. Cir.* 131 (1922), pp. 3-12, figs. 3).—A popular description is given of potato scab due to *Actinomyces scabies*, with suggestions for its control. Where there is only a slight amount of scab in the soil, the author recommends the plowing under of green manures and the use of acid fertilizers to reduce the damage done by the fungus. Where a large portion of the crop is rendered unsalable and it is necessary to plant the land in potatoes the following year, the use of sulphur is said to give good results in the control of scab. In his

experiments, the author found that sulphur mixed with 1 per cent of a culture soil well supplied with the organism that changes sulphur to an acid has given better results than ordinary sulphur. Where a heavy infestation of scab is suspected sulphur may be applied at the rate of 600 lbs. per acre, but if only a small portion of the crop is rendered unsalable an application of 300 lbs. may be found sufficient. The author states that the sulphur should not be mixed with the fertilizer nor applied in the row, but should be broadcasted just after the land is plowed and then harrowed into the soil.

The sugar beet nematode in the Western States, G. THORNE and L. A. GIDDINGS (*U. S. Dept. Agr., Farmers' Bul. 1248 (1922), pp. 16, figs. 10*).—A popular description is given of the attacks of *Heterodera schachtii* on the sugar beet. Surveys have shown that this organism prevails in a number of localities in Colorado, Utah, Idaho, and California, where it frequently causes considerable loss.

For the control of this nematode, crop rotations should be adopted and attention must be given to other host plants. The organism is known to occur on several plants other than beets.

Susceptibility of the different varieties of sweet potatoes to decay by *Rhizopus nigricans* and *R. tritici*, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research [U. S.], 22 (1921), No. 9, pp. 511-515*).—Investigations were conducted to determine the relative susceptibility of a number of the commercial varieties of sweet potatoes to infection and decay by *R. nigricans* and *R. tritici*. *R. nigricans* was employed for most of the inoculations, as it is the species most commonly found under storage-house conditions. *R. tritici*, although not as common, proved to be a very parasitic species, especially under artificial conditions.

The results of the experiments show that of the 16 varieties of sweet potatoes tested all were more or less susceptible to decay by *R. nigricans*, but there were some varietal differences. The varieties Nancy Hall and Southern Queen, which were the most resistant to *R. nigricans*, proved susceptible to *R. tritici* at a temperature of from 20 to 22° C.

Development of wilt-resistant tomatoes, F. J. PRITCHARD (*U. S. Dept. Agr. Bul. 1015 (1922), pp. 18, pls. 10*).—An account is given of the work of the author and others in the development of varieties of tomatoes resistant to wilt due to *Fusarium lycopersici*. Selections have been made from a number of commercial varieties, and upon field trial some of them have retained their resistant qualities to a very considerable degree. Three varieties originated by the author and one in cooperation with the Maryland Experiment Station are described at some length, and these are said to have produced heavy crops of excellent fruit on land so heavily infested by wilt that ordinary tomatoes could not be grown. Most varieties have been found to transmit the same degree of wilt resistance to their descendants as possessed by themselves, and only in a few instances was resistance increased by second selections.

Temperature relations of stone fruit fungi, C. BROOKS and J. S. COOLEY (*Jour. Agr. Research [U. S.], 22 (1921), No. 9, pp. 451-465, figs. 24*).—The results are given of investigations of the temperature response of the Mouillia form of *Sclerotinia cinerea* and of *Rhizopus nigricans*, two fungi which cause heavy market losses of peaches and other stone fruits.

In the experiments, fruits of cherries, prunes, and peaches were inoculated with cultures of the organisms, after which they were placed in moist storage chambers where they were kept at the temperatures desired. Comparisons were

also made of the behavior of the fungi on agar cultures held at the same temperatures. At a temperature of 10° C. (50° F.), *Monilia* was held in check for 1 or 2 days and *Rhizopus* for 3 days. At 7.5° *Monilia* was kept in check for 3 days and *Rhizopus* for 6 or more days. At a temperature of 5° *Monilia* was held entirely in check for 4 days and at 2.5° for 6 days. Peaches stored at 10° immediately after inoculation were from 3 to 5 days slower in developing rot than those delayed 1 day at 25° before storing at 10°. Peaches stored immediately at 7.5° were 5 days slower in developing brown rot than those delayed 1 day at 25° before storing at 7.5°. Low temperatures resulted in relatively less inhibition of growth with *Monilia* when grown on peaches than when grown on potato-dextrose agar. A relatively greater inhibition with *Rhizopus* took place when grown on peaches than when grown on potato-dextrose agar. Both fungi grow at lower temperatures on ripe fruit than on green fruit.

The results of this investigation are believed to be of value as showing that low temperatures control peach rots and the importance of securing these temperatures promptly.

Collar rot [of fruit trees in the Yakima Valley], L. POWELL (*Better Fruit*, 16 (1921), No. 4, p. 10).—Several fatal types of the so-called collar rot exist locally. A few cases occur also of pear or fire blight attacking the tree trunks, though these are easily controlled.

Transportation rots of stone fruits as influenced by orchard spraying, C. BROOKS and D. F. FISHER (*Jour. Agr. Research* [U. S.], 22 (1921), No. 9, pp. 467-477, figs. 6).—The results are given of five years' experiments in the shipping and storing of prunes and cherries to determine the underlying facts responsible for transportation and market losses in fruit shipments. Sprayed and dusted fruit were compared with untreated fruit from the same orchards under various conditions of transportation and storage.

The spoilage of fruits has been found almost entirely due to *Monilia* or brown rot (*Sclerotinia cinerea*), blue mold rot (*Penicillium expansum*), and black mold rot (*Rhizopus nigricans*). The investigations showed that *Monilia* attacks fruit both in the orchard and on the market, but the other fungi were able to develop only on the harvested fruit. Orchard spraying reduced the amount of *Monilia* or brown rot on sweet cherries from 24.3 to 6.4 per cent. On prunes the rot was reduced from 28 per cent on the untreated fruit to 7.1 per cent on the sprayed or dusted fruit. About half the brown rot control secured in the shipping tests with prunes and about one-third with cherries was considered due to the spray applied three or four weeks before picking time. But little difference in brown rot control was noticed with sulphur dust as compared with the standard spray materials. Spraying and dusting proved to have little or no effect on the development of *Penicillium* and *Rhizopus* rots in transit and storage, their occurrence being influenced by the prevalence of bruises and skin punctures.

Fungicides in the orchard, W. L. DORAN (*N. H. Hort. Soc. Ann. Rpt.*, 11 (1919), pp. 25-31).—The principal fruit diseases in New Hampshire are scab, sooty mold, and black rot. This paper is limited practically to a discussion of their control, chiefly through fungicides of the sulphur type (as lime sulphur and sulphur dust) and of the copper type (as Bordeaux mixture) with or without an arsenical. Nothing better than the usual applications of lime sulphur or Bordeaux mixture is deemed yet available, though these are admitted to have their drawbacks.

Mixed sprays for fruit trees, J. FEYTAUD (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 195-236, figs. 5).—Arsenical treatments applied

in spring extend their protective influences as far as the second generation of insects as regards blooms, fruit, and foliage. No great advantage is claimed for replacement of lead arsenate by calcium arsenate. Admixture of lead arsenate with lime-sulphur mixture (or Bordeaux mixture, particularly when the reaction is alkaline on account of greater adherence) is favored. The addition of resin soap appeared to be disadvantageous. The association of lime arsenate with alkaline polysulphid was more effective than was that of lime arsenate with lime sulphur. Arsenic salts increased the effectiveness of fungicides against fruit spotting, which was decreased markedly also by the action of lead arsenate used alone. The repetition of the above treatment was advantageous.

To simplify by limiting treatment to the essentials, 500 to 720 gm. of lead arsenate should be added to [100 liters] lime sulphur having a density of 1.008 (5 per cent strength) or a Bordeaux mixture having 1 per cent copper sulphate and 3 to 5 per cent slaked lime (or 1.5 to 2.5 per cent quicklime).

Bordeaux-oil emulsion, F. M. O'BYRNE (*Fla. Plant Bd. Quart. Bul.*, 6 (1922), No. 2, pp. 46-58).—An account is given of experiences with Bordeaux mixture alone and in combination with oil for the purpose of controlling simultaneously fungi and scale insects. Directions are given for making, testing, and using the emulsion.

Copper and grape downy mildew, L. TRABUT (*Prog Agr et Vitic (Ed. l'Est-Centre)*, 42 (1921), No. 1, pp. 18-20).—Referring to statements by the Villedieu (E. S. R., 45, p. 49), controverting the claims usually made regarding the fungicidal efficiency of copper compounds, particularly as used against grape downy mildew (*Peronospora*), the author calls attention to his own statement published as early as 1895 (E. S. R., 7, p. 39) regarding the resistance of a fungus (*Penicillium*) growing and apparently developing new characters in concentrated copper sulphate, though this fungus did not grow in weak iron sulphate. These and other facts are discussed in their bearings upon the question of disease control.

Report on [citrus canker] eradication work [in Florida] in cooperation with the Bureau of Plant Industry, for quarter ending December 31, 1921 (*Fla. Plant Bd. Quart. Bul.*, 6 (1922), No. 2, p. 59).—Up to December 31, 1921, no new case of citrus canker infection appeared in Florida since the last semiannual report (E. S. R., 46, p. 850). No properties showed active infection at that date, though five properties were still not known to be free from canker. The small canker area discovered and treated by burning the trees, in July and August, 1920, appears to have been completely freed from the disease. With the exception of that isolated center, no canker has been known to exist in Florida since the few cases (not over four) in the spring and summer of 1919, and none before that time since June, 1918.

Heart rot of coconut palms, H. MORSTATT (*Tropenpflanzer, Beiheft*, 20 (1920), No. 3, pp. [2]+71-124, figs. 2).—This includes a description and discussion of primary and secondary coconut palm heart rot (which may or may not occur together). Both of these are said to be due in most countries to a bacterial organism supposed by Johnston (E. S. R., 26, p. 649) to be *Bacillus coli* in the West Indies. A primary heart rot noted in other localities has been ascribed to *Pythium palmivorum*. Insects are important carriers of the infection.

Sclerotium disease of Liberia coffee in Surinam, G. STAHEL (*Dept. Landb. Suriname Bul.*, 42 (1921), pp. 34, pls. 11).—This article comprises an account of the gross and microscopic symptoms of a disease of coffee, together with infection tests and culture studies resulting in the separation of the causal organism as a new species, to which the name *S. coffeicolum* is given.

On a fungus—Ovulariopsis papayae n. sp.—which causes powdery mildew on the leaves of the pawpaw plant (*Carica papaya*), P. A. VAN DER BIJL (*Roy. Soc. So. Africa Trans.*, 9 (1921), pt. 2, pp. 187-189, pl. 1, fig. 1).—Papaya (*C. papaya*) along the coast of Natal is often affected with a mildew on the lower leaf surfaces, which is said to be due to the presence of a fungus thought to be new, and technically described herein as a new species under the name *O. papayae*.

Pecan rosette: Its histology, cytology, and relation to other chlorotic diseases, F. V. RAND (*U. S. Dept. Agr. Bul.* 1038 (1922), pp. 42, pls. 12).—In a previous publication (*E. S. R.*, 32, p. 241), the results of field studies on pecan rosette were described. Subsequent investigations have been carried on by the author on the histology, cytology, and relation of this disease to other chlorotic diseases, and in his opinion the pathogenic nature of pecan rosette is more in agreement with the infectious type of chlorosis, including yellows and mosaic, than with the forms of chlorosis known to be caused directly by soil or climatic conditions. The disease has not yet been definitely and experimentally caused by any set of known conditions, and it is not known whether the factors responsible for alterations in the normal structure and metabolism of the plant must be introduced from without, or whether they originate within the plant itself.

Treatment of forest seed beds with disinfectants to prevent damping-off, J. KAY (*Roy. Scot. Arbor. Soc. Trans.*, 35 (1921), pt. 1, pp. 70-72).—Ordinary commercial sulphuric acid appears to be the cheapest and most effective preventive of damping-off in forest seed beds, heat and formaldehyde proving expensive and less reliable. In case of a chemical disinfectant, sufficient water must be used to carry it through the soil to a depth of several inches. The concentration of the solution does not, within certain limits, appear to be a very important factor, since watering during the germination period prevents high surface concentration (and consequent injury to the seedlings), yet does not prevent adequate disinfection. Treatments are outlined as adapted to heavy or sandy soils.

A newly recorded disease on Japanese larch, caused by *Phomopsis pseudotsugae* (*Roy. Scot. Arbor. Soc. Trans.*, 35 (1921), pt. 1, pp. 73, 74).—A report by M. Wilson, after his examination of a specimen of Japanese larch obtained from G. Leven and supposed by the latter to be affected with a *Phomopsis* similar or related to that attacking Douglas fir, confirms this view and treats the attacking fungus as probably identical with *P. pseudotsugae*. This is said to be the first record of this fungus on *Larix leptolepis*, though it is here noted as occurring on dead shoots of young *Tsuga albertiana* in Fifeshire. It is mentioned as noteworthy that both on the Japanese larch and on *T. albertiana* the spores agree exactly in shape and size with those of the fungus on the Douglas fir, and hence differ markedly from those of *P. abietina* on *Abies pectinata* according to a description by Hartig. A further account of the fungus on these two new hosts is contemplated.

Investigations of the white pine blister rust, P. SPAULDING (*U. S. Dept. Agr. Bul.* 957 (1922), pp. 100, pls. 6, figs. 13).—The author has brought together the available data regarding the white pine blister rust so that other investigators can determine what further studies are desirable. The behavior of *Cronartium ribicola* is given in considerable detail, and summaries of control measures which have been investigated are reported upon in considerable length.

From the data presented it appears that the disease is of Asiatic origin, where its original host plant is thought to have been *Pinus cembra*. It was probably introduced into this country from Europe on young pine trees late

in the nineteenth century. The life history of the fungus on pines and on species of *Ribes* is described at length, and the known and suspected host species of *Pinus* and *Ribes* are enumerated. The organism is said to overwinter on pines and under some conditions on *Ribes* also.

Of the control measures investigated, the most practical seems to be the eradication of all *Ribes* within 200 to 300 yds. of white pine trees.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

American moles as agricultural pests and as fur producers, T. H. SCHIEFER (*U. S. Dept. Agr., Farmers' Bul. 1247 (1922), pp. 23, figs. 16*).—This gives a summary of information on the common moles of the United States, including damage caused, natural enemies, and control measures. The fact that the skins of some American moles, especially those found in western Washington and Oregon, are larger and have better texture than those from Europe has been recognized, and there is now a demand for American moleskins by some important American fur dealers. Directions are given for the skinning of moles, stretching, drying, tanning, and the utilization of their pelts.

Twenty-first report of the State entomologist of Connecticut for the year 1921, W. E. BRITTON (*Connecticut State Sta. Bul. 234 (1922), pp. 111-204, pls. 16, figs. 6*).—Following a statement of the receipts and expenditures of the year, the author reports upon the entomological features of 1921, the nursery inspection work, inspection of imported nursery stock, and inspection of apiaries. This is followed by a Report of Gipsy Moth Work, Season of 1920-21, by J. T. Ashworth and W. E. Britton (pp. 132-145) and Notes on the European Red Mite (*Paratetranychus pilosus* C. & F.), by P. Garman (pp. 146-152), the data relating to control work with which are largely in tabular form. The results obtained in red mite work demonstrate the value of miscible oils as acaricides, but it is pointed out that if used in excessive quantities such oils may become dangerous to apple trees, especially if long continued. In the light of present information it is advised that miscible oils be applied for the control of this mite in Connecticut before the buds open, in March or early April.

Studies of The Violet Gall Midge (*Phytophaga violicola* (Coq.)) are reported upon by P. Garman (pp. 152-156). By the fall of 1920 it had become numerous enough in greenhouses in West Hartford to require continual hand picking and was causing a yearly loss to the company of about \$1,000. Studies made of it and here reported have led to the belief that careful systematic fumigation with hydrocyanic acid gas offers an economical and satisfactory relief.

An Outbreak of the Arbor Vitae Leaf Miner (*Argemasthia thuella* Pack.) is considered by W. E. Britton and M. P. Zappe (pp. 157-160). This lepidopteran is a source of injury to arbor vitae at New Haven through its mining the narrow leaflets so that in the most extreme cases almost all the chlorophyll is destroyed. Tests made of a number of insecticides are briefly reported, from which no recommendations can as yet be made.

Injury to Young Tobacco Plants by the Seed Corn Maggot, *Hylemyia ciliatella* Rond. (pp. 161-163), is next considered. The seed corn maggot was a source of injury in a large section of a shade tobacco field due to tunneling in the stem. Any injury to the pith of the tobacco plant is said to be sufficiently serious to prevent the plant from ever developing a good crop of wrapper leaf tobacco. Following its attack, a 20-acre field of shade tobacco was entirely reset and no injury from it was noticed on the later set plants.

Tests of Materials for the Control of Wireworms are briefly reported upon by M. P. Zappe (pp. 163-165). None of the remedies tested proved to be of

value. A summary of information on The Corn Earworm, *Chloridea obsoleta* Fab. (pp. 165-170), next given, includes a list of 18 references to the literature. The Asparagus Beetles (pp. 171-175), namely, the common asparagus beetle and the twelve-spotted asparagus beetle (*Crioceris duodecimpunctata* L.) are next considered. This is followed by an account of The Tulip-Tree Scale, *Toumeyella liriiodendri* Gme. (pp. 176-178), which occurs throughout the State on tulip trees and is also found each year in late summer in the nurseries. The best treatment consists in spraying the trees as soon as the leaves drop in autumn with a concentrated liquid lime sulphur, one part in nine parts of water. Brief accounts are given of other scale insects, including The Cottony Maple Scale (pp. 179-181), The Pine Leaf Scale, *Chionaspis pinifoliae* Fitch (pp. 181-183), The Terrapin Scale (pp. 183-185), and The Euonymus Scale (pp. 185, 186).

The Rapid Spread of the Apple and Thorn Skeletonizer (*Heimerophila pariana* Clerck) is considered (pp. 186-188), this pest apparently having spread through all of the eight counties of the State except Windham. The Abundance of the German Roach in a City Dump, *Blattella germanica* L. (pp. 188, 189), and The Mealy Flatas, *Ormenus pruinosa* Say and *O. septentrionalis* Spin. (pp. 189, 190), both by B. H. Walden, and Mosquito Control Work, Season of 1921, by S. T. Sealy (pp. 190-193), follow in order. The report concludes with a presentation of miscellaneous insect notes (pp. 194-202).

[Report of the] department of entomology (*Indiana Sta. Rpt. 1921*, pp. 22, 23, fig. 1).—In experiments conducted at Fort Wayne and Hammond, two applications of corrosive sublimate consisting of 1 oz. to 10 gal. of water and a 1 per cent dust mixture of corrosive sublimate and gypsum or hydrated lime effectively controlled the maggot in cabbage and cauliflower. One treatment with the liquid was effective in controlling it in the radish.

A dust mixture of calcium arsenate and gypsum (1:20) successfully controlled the striped cucumber beetle. The effectiveness of the creosote barrier line in combating the chinch bug has been clearly shown in many sections of the State. Several clover pests are increasing in importance, namely, the clover leaf weevil (*Phytonomus punctatus*), the lesser clover leaf weevil or clover bud worm (*P. nigrirostris*), and the clover root borer.

Fumigation with sulphur, W. F. SCHLUPP (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 2, pp. 132-140).—This is a discussion of the use of sulphur dioxide in combating poultry pests, stored grain pests, in empty storerooms, its effect on rats and mice in storerooms, against bugs in houses, and the manner of its application.

Stored grain pests, E. A. BACK and R. T. COTTON (*U. S. Dept. Agr., Farmers' Bul. 1260* (1922), pp. 47, figs. 64).—This is a summary of information on some 40 species or groups of species which attack grain in storage and shipments, of which four species are the source of most of the damage, namely, the granary weevil, the rice or black weevil, the lesser grain borer (*Rhizopertha dominica* Fab.), and the Angoumois grain moth.

Insects pests of stored grains and their control, M. H. SWENK (*Nebraska Sta. Circ. 15* (1922), pp. 14, figs. 9).—Brief accounts are given of the more important insect enemies of stored grain, with preventive and remedial measures.

The avocado: Its insect enemies and how to combat them, G. F. MOZETTE (*U. S. Dept. Agr., Farmers' Bul. 1261* (1922), pp. 31, figs. 21).—This publication gives brief descriptions of insect enemies of the avocado and their life histories, and the means found most effective in each case for combating them. The principal insect pests of the avocado in Florida at the present time, of which summarized accounts are here given, are the dictyospermum scale

(*Chrysomphalus dictyospermi* Morg.), the avocado white fly (*Trialeuroder floridensis* Q.), the pyriform scale, the blossom Anomala (*A. undulata* Mels.), the avocado lace bug (*Acysta perscae* Heid.), the avocado blossom thrips (*Frankliniella cephalicus* Craw.), the avocado leaf roller (*Gracilaria perscae* Busck), the avocado red spider (*Tetranychus yothersi* McG.), and the greenhouse thrips. Earlier accounts of many of these pests have been noted from other sources (E. S. R., 46, p. 458).

Several very destructive insect enemies of the avocado, the introduction of which into this country should be guarded against, are the weevil *Heilipus lauri* Boh., which occurs in Mexico and Guatemala; the weevil *Conotrachelus perscae* Barber, which occurs in Guatemala; and the Mediterranean fruit fly (*Ceratitis capitata* Wied.).

Control of apple red bugs by dusting, P. J. PARROTT, H. GLASGOW, and G. F. MACLEOD (*New York State Sta. Bul.* 490 (1921), pp. 3-30, pls. 5).—This bulletin reports experiments with spraying mixtures and with certain insecticidal materials in powdered form conducted with a view to determining the value of dusting in protecting apple orchards from injuries by the bright red bug (*Lygidea mendax* Reu.) and the dark red bug (*Heterocordylus malinus* Reu.), the details of which are reported in tabular form. It was found that spraying and dusting mixtures containing nicotin sulphate are toxic to these pests, the nymphs and adults of both species proving to be very sensitive to such treatment. The number of insects in these stages on bearing apple trees were reduced to a large extent by thorough applications of effective mixtures.

"Measured by the number of red bugs dislodged from the trees and the percentage killed by the treatments, dusting preparations containing 0.25, 0.5, 1, and 2 per cent nicotin, respectively, were toxic to the insects. Effective results were also obtained with spraying mixtures at standard strengths. Nicotin sulphate at rates of 0.25 and 0.5 pint to 100 gal. of either soap or lime sulphur solution showed considerable toxicity to the insects. Dusting and spraying preparations with the larger amounts of nicotin gave, on an average, more uniform results and displayed higher killing power than those containing smaller amounts. In a dusting experiment in a 20-year-old Baldwin orchard a larger percentage of the red bugs was killed by a 5-lb. dosage per tree than by a 2-lb. dosage per tree. The results of the experiments as a whole indicate that both dusting and spraying mixtures should be used in rather liberal amounts and carefully applied in order to destroy the majority of the insects. Prevailing conceptions of dosage requirements for typical bearing orchards in this State tend to underestimate the amount of material necessary to accomplish effective results."

The average cost of treatment per tree for labor and material in treating 20-year-old trees with power outfits, not including interest on investment and depreciation of machinery, was found to range from as low as 18 cts. per tree for lime sulphur with nicotin (1 pint) where 5.72 gal. were used, to \$1.25 for a 2 per cent nicotin dust (5 lbs.). "The effectiveness of dusting preparations was uninfluenced, at least to an appreciable extent, by temperatures ranging from 44 to 87° F., by slight dampening by dews or showers, or by freedom of foliage from moisture. Strong air currents made thorough dusting difficult, caused wasteful use of materials, and tended to render applications less effective. Dusting was most satisfactorily accomplished when the air was still or only slight air currents prevailed."

It is concluded that "considering the needs of average growers and prevailing prices for material and labor, the apple red bugs can be more efficiently and economically controlled by spraying than by dusting. In large commercial orchards dusting could doubtless be used to great advantage in a supple-

mentary capacity to the usual spraying operations. Tobacco dust which was ground until 50 per cent of the material passed through a 100-mesh sieve possessed marked insecticidal properties. Promising results were also obtained with the material in combination with either soap or lime sulphur solution. Derris and soap displayed a high rate of toxicity against red bugs. Of vital importance in furthering an extensive employment of dusting for the control of sucking insects is the need of more economical materials which function efficiently as contact insecticides. . . . In view of the data presented, it is concluded that apple red bugs may be effectively controlled by thorough dusting with sulphur and arsenate of lead containing 0.5, 1, and 2 per cent nicotine."

Hopperburn (tipburn), J. E. KOTILA (*Michigan Sta. Spec. Bul. 110 (1921), pp. 30-33, figs. 3*).—The importance of this affection of the potato in the Upper Peninsula of Michigan was revealed during the course of a survey made the latter part of July, 1919. Potato fields in five of six different counties visited had been seriously injured, many fields being a total loss, the tops having been killed before the tubers had reached a marketable size. The injury was found to be more serious on light than on heavier soils, and early varieties were more susceptible than late maturing varieties. Observations made on the variety plats at the station confirmed the findings of the survey. Bliss Triumph was found to be the most susceptible of the early varieties, followed in order by Early Ohio and Irish Cobbler. Of the late varieties Idaho Rural was most susceptible and was followed in order by Green Mountain, Russet Burbank, and Rurals. The last two varieties remained green throughout the entire season although the foliage was curled upward.

Investigations conducted during 1920 show that the leafhopper passes the winter in the adult stage, and in the spring feeds on various field crops and weeds until the early potatoes break through the ground, when the adults fly to the potato fields. Eggs are laid in great numbers on the young potato vines, thousands having been known to have been laid on a single hill. Approximately 15 days are required for incubation of the egg and a similar period for the nymphs to reach maturity. Thus, a month or 35 days is required for the completion of the life cycle. It is thought that in favorable seasons there are two generations under Upper Peninsula conditions, the first generation reaching the adult stage during the latter part of July and the second generation during the latter part of August and the first of September.

Potato plants at the station were sprayed weekly with a 5:5:50 Bordeaux mixture, five applications being made during the growing season. On September 5 hill counts for hopperburn showed 1.71 per cent on sprayed and 27.75 per cent on the unsprayed plats. Thus the application of Bordeaux mixture reduced the loss to a minimum.

Control of the citrophilus mealybug [*Pseudococcus gahani* Green], R. S. WOGLUM and A. D. BORDEN (*U. S. Dept. Agr. Bul. 1040 (1922), pp. 20, figs. 13*).—An infestation by what proved to be *P. gahani*, with which *P. citrophilus*, described by Clausen in 1915, is synonymous, was first observed in the fall of 1913 on some 3 acres of citrus at Upland, Calif., and soon after at Pasadena, since which time it has spread and increased in importance. By 1917 approximately 600 acres were infested at Upland, while over 100 acres of citrus were found in 1916 to be infested at Riverside, where at the present time the infestation covers approximately 250 acres. Smaller infestations are recorded at Cucamonga and Alhambra on citrus, and it is reported at Long Beach and Los Angeles on ornamentals and occurs in the northern part of the State in the San Francisco Bay region. Its distribution takes place in a number of ways, namely, in picking boxes and sacks, clothing of pickers and pruners, teams, wagons, ladders, etc., and several new infestations have been

definitely traced to distribution through picking boxes previously used to transport infested fruit. In addition to citrus, it occurs on a large number of other plants, principally ornamentals, upward of 30 different species being listed as hosts.

The migration, which usually begins during the early part of April and continues throughout the month of May, is a most important feature in the biology of this insect. Over 90 per cent of the insects take part in this movement, which results in their settling on the rough places in the bark of the main limbs and trunk, where they soon commence ovipositing. The egg masses begin to hatch the latter part of May or early part of June, and the young larvae migrate back up the main limbs to the foliage and young fruit and settle along the midribs of young foliage, on the tenderest twigs, and under the sepals of the green fruit. By late fall many have become half grown and have settled in the most secure positions on the bud end or navel end of the fruit or between the fruit in clusters, and their development from then on is very irregular.

In not a single instance has this mealybug become serious except where it has been attended by the Argentine ant, an account of the control of which has been noted (E. S. R., 46, p. 160). Two demonstrations of control are reported upon, and the results of the control work in the Upland district in 1919 are described. Control measures are summarized under the following headings: (1) Ant control, which is most effectively accomplished by the use of Barber's formula for arsenical poison sirup applied in small containers during the autumn or spring; (2) trunk banding, which consists in placing strips of burlap about 5 in. wide around each tree trunk from February to April to attract ovipositing female mealybugs; (3) removal and dipping of burlap bands in distillate before spraying the trunk thoroughly with distillate-soap powder emulsion; (4) trunk treatment, consisting in the application of distillate-soap powder emulsion after the mealybugs have massed on the trunks and just before the eggs begin to hatch, usually during the latter part of May; and (5) the propagation and distribution of *Cryptolaemus montrouzieri*, *Leucopis bella*, *Chrysopa* spp., and *Scymnus sordidus*.

Rose bushes in relation to potato culture, E. M. PATCH (Maine Sta. Bul. 303 (1921), pp. 321-344, pl. 1).—This is a summary of information and report of investigations of the pink and green aphid of potato (*Macrosiphum solanifolii* Ashm.), which is a source of injury both through its direct attack and its transmission of disease. In an earlier work (E. S. R., 34, p. 550), the author records the discovery in 1915 that the rose bush is the long sought overwintering or alternate host of this pest, thus supplying the missing link in its life cycle. The present bulletin presents the results of investigations conducted in large part during 1921.

The first two spring generations of *M. solanifolii* have never been found by the author developing on any other plant than the rose bush, and she feels convinced that the rose is the only primary host plant of any significance for Maine conditions. It is pointed out that, though not always the case, it is not uncommon for a migratory species of aphid to accept a much broader group of plants for its summer home than for its winter and spring home. *M. solanifolii* has a conspicuously wide range of such secondary food plants, a list of which is presented, including 84 species representing 32 families.

The winged individuals of the second rose generation are the earliest of the spring migrants, and after they become mature they no longer feed upon the rose but take flight to some plant suitable for their summer colonies, such a plant being called the secondary or summer food plant. While living during the summer on the potato the two color varieties of females, either green or pink, bring forth their successive generations of young, both winged and

wingless. During late summer and early fall winged individuals develop on the potato that differ from all the previous winged forms, in that after acquiring wings they have no further interest in the summer food plant. These are the fall or return migrants and their flight, as their name indicates, takes them to the rose, the primary food plant of the species, upon which their progeny later deposit the overwintering eggs. Upon the potato the species not only attacks the terminal shoots and leaves, but colonize the blossom clusters, which wilt and wither. Colonies also occur on the underside of the lower leaves, which latter location the author found to be one of the favorite resorts of the pest at Presque Isle during the season of 1921. It is thought probable that the ground leaves will be used more by this species during a very dry season than in a wet one. Not only is the infection of mosaic disease transmitted from diseased to healthy plants, but leaf roll is also subject to transmission by aphids.

In her investigation of the rose bush situation in northern Aroostook, no wild roses were found in hedgerows, woodland fringes, swamp borders, and hillside growths, and it is concluded that such native roses in the northern part of that county as there may chance to be are not sufficiently abundant to jeopardize the potato seed industry by the number of pink and green aphids that could overwinter on them. While the author failed to find any roses native to that locality, a great many uncultivated ones were found occupying dooryards, particularly old dooryards, or running out from such places along a road for some distance as if escaped. These tame wild rose clumps are thought to be the persistent hardy wild stocks upon which had been grafted the more tender cultivated varieties introduced north of their climatic range. It is stated that during the season of 1921 about 2,000 such wild rose stems were found in two old dooryards within easy aphid flight of Aroostook Farm. In addition to the tame wild roses, cinnamon roses abound in the same sort of neglected clumps in fence corners and in the vicinity of deserted houses and burned ruins. *Rosa rugosa* has been rather commonly planted, and here and there a bed of Scotch roses or a Rambler or two.

In answering the question "How far can an aphid fly?" the author records observations that have led her to suggest for the growers of certified potato seed the slogan: "A mile from the nearest rose bush." Five fields on Shippigan Island were examined for aphids, and infestation was found in two near the ferry in the vicinity of rose bushes, but none was found in three fields located at a greater distance away.

In discussing remedial measures, it is pointed out that the first step is the destruction of rose bushes by digging them out, and that in northern Maine October and November is the most favorable time, to be followed by a second grubbing in the spring if overlooked shoots start up. Where they can not be removed in the fall, any time before the first of May will serve the purpose. The grubbed out rose bushes should be burned to destroy the aphid eggs. It is pointed out that the aphids on rose bushes which it is desired to preserve can be greatly reduced in numbers by thorough spraying early in September and again in early June. Fumigation of the rose bushes, using tents or large portable box cages, could be conducted on a cooperative basis by the potato growers in a community and would be a more certain method. Where roguing is practiced the plants should be removed at once from the vicinity or treated so as to render them harmless, since the aphids will leave the wilting vegetation for fresh plants, and an enforced dispersal from diseased to well plants would occur, thus lessening the effectiveness of the roguing. In considering the effectiveness of rose bush destruction, the author reports she knows of no case in the North where any species of aphid attains the economic

status of a serious pest in the absence of its normal primary host. In the South, however, it is possible for many species to maintain themselves by virtue of a continuous viviparous reproduction, and the overwintering eggs play a less important rôle than in a cold climate, where they are a necessary link in the annual cycle.

While the pink and green aphid appears to be the principal agent in the dissemination of mosaic disease, attention is called to the fact that certain other potato insects may be able to transmit it. If the tarnished plant bug should prove to be a carrier of this disease, it would possibly outrank in economic importance, on account of its numbers, all other Maine potato insects combined except the pink and green potato aphid. That the percentage of plants affected with mosaic disease in certain potato fields in New Brunswick, where control has never been practiced, is still so low as to suggest "immunity," while others in the same region have been known to run as high as 100 per cent mosaic, is attributed to the presence or absence of dooryard rose bushes in the vicinity. That the mosaic disease was so low in certain localities along the north shore is thought to have been due to the fact that the winds to a certain extent have deaphidized the rose bushes.

A list of 16 references to the literature cited is included.

A meadow caterpillar "the adventurer" (*Ctenucha virginica*), E. M. PATCH (*Maine Sta. Bul.* 302 (1921), pp. 309-320, pls. 2).—This is an account of a meadow insect which attracts attention even when not abundant, due to the striking appearance and the peculiar habits of both the caterpillar and moth. That it is constantly present without becoming abundant is thought to be due to natural checks. The fact that the caterpillar is often active during a winter's thaw in the North, when most caterpillars are dormant, and that the moth flies by day, when most moths are hiding, led the author to apply the name "adventurer." On April 22, 1920, the author observed 20 of these black and yellow grass caterpillars in a square yard of a field near Orono, Me., for which an estimate of 4,000 per acre seemed conservative. During the summer of 1920 the adults were collected in the field from late May to early August, being most abundant from the middle of June to the middle of July.

The eggs are deposited in close-set rows, lengthwise on the grass blade, the number of rows being controlled in part by the width of the grass blade. Several batches of eggs are deposited by a moth, 185 having been the highest total laid by a caged individual. Eleven or twelve days are passed in the egg stage. The caterpillars become dormant with the approach of cold weather, but thaw out with warm days in the winter, and at such times are frequently found roving restlessly over melting snow, as is also their habit in early spring. Caterpillars fed in the laboratory in September ate Italian rye grass, English rye grass, smooth brome grass, Japanese millet, Rhode Island bent grass, creeping bent grass, timothy, redbud, Kentucky blue grass, and witch grass, and the authors found them in the spring feeding in the field on witch grass, sedge, and Iris. The caterpillars construct their cocoons and pupate from the middle of May to early in June, and the adults were collected in 1920 from late May to early August.

Natural checks are considered under the headings of weather, birds, and parasites. An undetermined dipteran and five hymenopterans, namely, *La-bronychus* sp. near *L. prismaticum* Nort., *Amblytelus* sp., *Coclopietha* sp. near *C. confusa* Gir., *Iseropus coelebs* (Walsh), and *Telenomus spilosomatis* Ashm. were observed by the author at Orono.

Lepidoptera injurious to the apple in Pennsylvania, S. W. FROST (*Pennsylvania Sta. Bul.* 169 (1921), pp. 16, figs. 10).—Investigations at the station on apple-deforming insects have led to the recognition of certain newer forms as

responsible for particular types of scars. In order to make this information available these data are presented as preliminary to a more complete report of the investigation. A classification of the scars produced on the fruit, a classification of the lepidopterous feeders on apple, a key to the Microlepidoptera of Pennsylvania which feed on the foliage and fruit of the apple, a key for the determination of the larvae, and an account of the more injurious Lepidoptera attacking apples are given.

Gas treatment for peach borer: Paradichlorobenzene saves tedious hand worming. H. A. GOSSARD (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 1-2, pp. 39, 40).—This is a brief account, which gives directions for the use of paradichlorobenzene in combating the peach tree borer.

Red cedar chests as protectors against moth damage. E. A. BACK and F. RABAK (*U. S. Dept. Agr. Bul.* 1051 (1922), pp. 14, pls. 5).—This is a detailed report of investigations of the value of red cedar chests as a protection from the webbing clothes moth (*Tincola bisselliella* Hum.), including their effect upon the eggs, the larvae, and the adults. It was found that chests made of the heartwood of red cedar (*Juniperus virginiana*), if made sufficiently tight to prevent the entrance of moths, are effective in protecting the fabrics from clothes-moth attack if precaution is taken to heat, brush, and when possible, sun articles before placing them in the chest. The experiments indicate that chests retain indefinitely their value as protectors against moth ravages provided they are cared for properly.

"Since it is the odor of red cedar which is effective against moths, it is recommended that in using cedar chests for the protection of clothing, fabrics, and furs, special care should be taken to prevent undue escape of the aroma from the chests. The chests should remain tightly closed except when clothing is being removed or placed in them, and this procedure should be accomplished as rapidly as possible."

Such chests exert no noticeable effect upon the adult moths, and when they enter chests when open they may live as long as two weeks or even a month and lay many fertile eggs. While cedar chests are not effective against eggs whether laid outside the chest and accidentally introduced with the clothing or whether laid in the chest, yet the imprisonment of adult moths and eggs is not important since the young larvae promptly succumb to the effect of the chest, and neither the moth nor the egg are a source of injury. Cedar chests can not, however, be depended upon to kill after the larvae are three or four months old or are from one-half to full grown. While some of the half to full grown larvae placed in chests have died, their deaths may have been due to a normal mortality. Larvae hatching from eggs within the chests die in most instances within two or three days, and practically all die within two weeks. Larvae hatching outside the chest and introduced in clothing do not die so quickly as larvae hatching inside because they are older, but the majority of such larvae, which soon show a tendency not to feed, die during the first or second week, although some may live longer.

The authors call attention to the fact that while cedar chests may be regarded as protectors against clothes moths, a chest of ordinary wood, if as tightly constructed, will be just as effective if the clothes are as thoroughly cleansed, brushed, and sunned, and from 1 to 2 lbs. of good grade naphthalene packed within. Woolen garments freshly cleaned and thoroughly brushed will be well protected if tightly wrapped with naphthalene in several thicknesses of ordinary paper.

Cabbage root maggot control: The value of the tar-disk treatment demonstrated. R. E. LOREE (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 92, 93, fig. 1).—In a field of early cabbages in which 878 plants were protected

with tar-paper disks at the time of planting and 414 were left as a check, 71 per cent of the protected and 33 per cent of the unprotected plants produced marketable heads. Computed on an acreage basis, the yield from the unprotected plants was 7,500 lbs. per acre and from the protected plants 22,000 lbs. per acre, or an increase of nearly 200 per cent due to the use of tar-paper disks.

The tobacco flea-beetles, J. D. MORE (Porto Rico Dept. Agr. and Labor Sta. Circ. 50 (1921), Spanish ed., pp. 3-8, figs. 3).—This is a brief account of flea-beetle enemies of tobacco, of which mention is made of *Epitrix cucumeria* Har., *E. parvula* Fab., and *Systena basalis* Duv., and measures for their control.

A beetle borer of the coffee tree, Apate francisca Fab., G. N. WOLCOTT (Porto Rico Dept. Agr. and Labor Sta. Circ. 48 (1921), Spanish ed., pp. 5, 6, figs. 2).—The author gives a brief account of this insect, which is a source of injury to the trunk of the coffee tree in the western part of Porto Rico.

The boll weevil problem, W. D. HUNTER and B. R. COAD (U. S. Dept. Agr. Farmers' Bul. 1262 (1922), pp. 31, figs. 5).—This is a revision of Farmers' Bulletin 848 (E. S. R., 38, p. 62), in which particular attention is given to direct control by poisoning with calcium arsenate (E. S. R., 43, p. 856).

Disinfection of frames infected with American foulbrood, F. W. FABIAN (Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 98, 99).—The author has found the use of a lye solution consisting of 12.5 oz. to 8 gal. of water to be a good disinfectant for frames infected with American foulbrood. The solution of lye was brought to a boiling point, and the infected frames, scraped clean from beeswax, were boiled for five minutes in the solution. The causative organism was apparently completely destroyed in this way.

A sawfly injurious to young pines, W. MIDDLETON (U. S. Dept. Agr., Farmers' Bul. 1259 (1922), pp. 11, figs. 10).—This is a popular summary of information based on the investigations previously noted (E. S. R., 45, p. 159).

The slugs or "lapa" of tobacco and other crops, G. N. WOLCOTT and F. SEIN, JR. (Porto Rico Dept. Agr. and Labor Sta. Circ. 51 (1921), Spanish ed., pp. 5-8, figs. 2).—The common Porto Rican slug *Veronicella occidentalis* Guild., known there as the "lapa," is a source of injury to tobacco, beans, tomato, and lettuce.

FOODS—HUMAN NUTRITION.

Additional notes on adlay, [a Philippine food grain], P. J. WESTER (Philippine Agr. Rev., 14 (1921), No. 2, pp. 159-167).—In continuation of work previously reported (E. S. R., 45, p. 737), information is summarized regarding the food value, methods of cookery, and uses of adlay, a variety of "Job's tears," cultivated in a limited way in the Philippines and other regions of tropical Asia, and which, in the author's opinion, is worth extensive cultivation as a staple food.

Data regarding the composition of eight samples are quoted from analyses by H. A. Wells and F. Agcaoili. The calculated average from these gives 12.25 gm. as the weight of 100 grains, the hulled grain being 64.56 per cent and the waste 35.44 per cent of the total. The average composition of the grain is: Water, 10.36; protein, 11.78; fat, 4.95; carbohydrates, exclusive of crude fiber, 70.64; crude fiber, 0.76; and ash, 1.51 per cent. The fuel value is not reported but is calculated to be 1,697 calories per pound.

Considerable variation was noted in the composition and other factors reported upon, but in general, as the author points out, the protein content of adlay somewhat approximates that of wheat, as does the carbohydrate and starch content. In general, adlay is richer in fat than wheat, one of the samples containing more than four times as much, and four others more than

three times as much. Gluten was not found in the adlay flour, so "it can not be used for bread making without an admixture of wheat flour."

From such evidence as is available the author considers it reasonable to believe that adlay equals corn in respect to digestibility. A summary of earlier literature on adlay is included.

What others say about adlay (*Philippine Agr. Rev.*, 14 (1921), No. 2, pp. 168-177).—Extracts are quoted from the original news story about adlay and from other news items, press comments, and letters

Black discoloration in canned corn, F. F. FITZGERALD, G. S. BOHART, and E. F. KOHLMAN (*Natl. Canners Assoc. Bul.* 181. (1922), pp. 27).—An extensive investigation of possible methods of preventing the discoloration of corn canned in tin is reported, from which the conclusions are drawn that no variety of corn is free from possible discoloration and that there is no known procedure by which the canner may control his conditions or methods so as to prevent the formation of this iron sulphid discoloration. The possibility of discoloration has been found to be lessened by the use of young and tender corn of such a consistency as to permit the dispersion by shaking and solution of any black discoloration formed. It is further recommended that the corn be filled into the can at a temperature of at least 190° C, that the cans be filled as full as possible, sealed absolutely tight, and stored in the warehouse on their sides, and that all cans should be well shaken immediately before shipment.

A half century of public health, edited by M. P. RAVENEL (*New York: Amer. Pub. Health Assoc.*, 1921, pp. XI+461, pl. 1, figs. 7).—This volume, which was issued to commemorate the fiftieth anniversary of the founding of the American Public Health Association, consists of a series of historical articles by various contributors on different phases of public health work. Of particular interest in this section may be noted Progress in Federal Food Control, by C. L. Alsberg (pp. 209-220); Food Conservation, by S. C. Prescott (pp. 221-235); and Milk and Its Relation to Public Health, by C. E. North (pp. 236-289).

Nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Wash. Yearbook* 20 (1921), pp. 295-306).—This is the customary annual report of the nutrition laboratory of the Carnegie Institution (E. S. R., 45, p. 161). The additions to the equipment during the year include a Dreyer stadiometer, an apparatus for measuring with the greatest degree of accuracy the sitting and standing heights; a respiration apparatus for small laboratory animals which is to be installed in the department of nutrition at Teachers' College, Columbia University; and an emission calorimeter for use in the study of energy transformations in man during the conversion of carbohydrate to fat. Brief reports are given of investigations in progress and abstracts of publications issued during the year.

Diet in relation to normal nutrition, J. M. HAMILL (*[Gt. Brit.] Mtn. Health, Rpts. Pub. Health and Med. Subjs.* No. 9 (1921), pp. 49).—This is a brief discussion of present standards of nutrition with particular reference to the consideration which should be taken of vitamins in planning the diet.

The assessment of physical fitness, G. DREYER (*New York: Paul B. Hoeber*, 1921, pp. XIV+127, figs. 3).—In this volume, in the preparation of which the author has had the collaboration of G. F. Hanson, are presented in a concise form the author's theories concerning the relationships which exist between the weight of the body, the sitting height, and the circumference of the chest, and the relationship of these factors to the vital capacity of the lungs. These relationships are expressed by the formulas which are given in the following table:

Relationships between body weight, chest circumference, and vital capacity.

Sex.	Weight (W).	Circumference chest (Ch.).	Vital capacity (V. C.)
	Gm	Cm.	$\frac{Cm}{W^{0.72}}$
Males	$W = 0.38025 \times \frac{0.319}{\sqrt{\lambda}}$	$Ch. = \frac{\lambda^{1.1442}}{2.00118}$	$V. C. = \frac{0.69}{W^{0.72}}$
	$W = 0.662 \times \frac{0.365}{\sqrt{Ch.}}$		$V. C. = \frac{\lambda^{2.857}}{6^{1172}}$
			$V. C. = \frac{Ch^{1.973}}{1.5595}$
Females	$W = 0.36093 \times \frac{0.313}{\sqrt{\lambda}}$	$Ch. = \frac{\lambda^{0.9074}}{0.761833}$	$V. C. = \frac{W^{0.72}}{0.79348}$
	$W = 0.30213 \times \frac{0.284}{\sqrt{Ch.}}$		$V. C. = \frac{\lambda^{2.8003}}{8.2714}$
			$V. C. = \frac{Ch^{2.5392}}{16.4951}$

λ = the length of the trunk in centimeters.

For the practical application of these formulas tables have been constructed from data obtained on healthy, normal men and women. These data serve as constants from which the physical fitness of a person can be judged by comparison. In the tables dealing with vital capacity in its relation to weight, trunk length, and chest circumference, three readings of vital capacity are recorded for each given weight or measurement. These correspond to three classes representing conditions of perfect, medium, and poor physical fitness. In the first class would be grouped those leading an active life; the second, the professional class and those leading a more or less sedentary life; and the third, those leading a very sedentary life. The methods of taking the measurements and making the necessary calculations are described in detail.

The nomogram as a means of calculating the surface area of the living human body, W. M. FELDMAN and A. J. V. UMANSKI (*Lancet* [London], 1922, I, No. 6, pp. 273, 274, figs. 3).—The authors have constructed a nomogram by which the surface area of the body, according to the Du Bois weight-height formula (*E. S. R.*, 35, p. 370), can be calculated more rapidly than by the original chart. The derivation of this nomogram is discussed, with illustrative diagrams.

Remarks on standards for normal basal metabolism, J. H. MEANS and M. N. WOODWELL (*Arch. Int. Med.*, 27 (1921), No. 5, pp. 608-619, figs. 3).—This paper reports a comparison of the accuracy of prediction of the basal metabolism of normal subjects by the Du Bois height-weight surface area method (*E. S. R.*, 35, p. 370), the Harris-Benedict multiple prediction tables (*E. S. R.*, 41, p. 760), and the Dreyer body weight formula as noted above. It is concluded that the average deviation is essentially the same by each method, although the Du Bois deviations tend to run about two points lower than either of the others.

A similar study of a series of six obese subjects showed that while the Harris-Benedict method gave a slightly closer prediction than the other two, the deviations by all three methods were within what might be considered a normal limit of variation in all of the six subjects. Similar results were obtained in abnormal subjects such as patients with hypo- or hyperthyroidism, although on an average the Harris-Benedict deviation tended to be about 6 per cent, and the Dreyer about 7 per cent, higher than the Du Bois. "It is

suggested that, although the deviations by the three methods are very similar, nevertheless it is desirable to have uniformity, and that, therefore, the Du Bois method be continued, since it already is in common use and since the others appear to possess no material advantage over it."

Indices of the state of nutrition in children, H. GRAY and G. H. EDMANDS (*Amer. Jour. Diseases Children*, 23 (1922), No. 3, pp. 226-237).—A synopsis of the literature on indices of nutrition is presented, followed by the report of calculations of errors in prediction of weight by the Dreyer-Hanson tables noted above, the Pirquet standards (E. S. R., 44, p. 559), and the authors' ideal tables (E. S. R., 46, p. 563), as tested on 114 boys from a country day school near Boston. The conclusions drawn from this study are as follows:

"Although our ideal tables seem the most exact by a slight margin it is quite probable that for general use, on adults and children alike, the most satisfactory method hitherto proposed for estimating the correct weight of a normal person is the combination of Dreyer and Hanson's weight-for-stem and weight-for-chest tables, with the modification that the chest girth used be what we have called the mean girth rather than the resting girth advocated by Dreyer."

The chemistry of milk curd modification in infant feeding, R. W. TERRY (*Jour. Amer. Pharm. Assoc.*, 10 (1921), No. 5, pp. 345-362, figs. 4).—This is a discussion, based largely on the literature on the subject, of the chemical action of certain substances commonly used in infant feeding to modify the character of the milk curds.

A study of the effect produced on the composition of milk by the administration of certain inorganic and organic substances, W. DENIS, W. R. Sisson, and M. ALDRICH (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 315-322).—The hypothesis is advanced that "it should in most cases be possible to predict the result of feeding experiments made with the object of producing changes in the composition of the milk (at least as regards a single constituent), provided data are on hand concerning the possibility of altering the concentration of this specific constituent in the blood." This hypothesis has been tested by feeding goats urea and calcium chlorid, respectively, and determining the amount of urea nitrogen, calcium, and chlorin in the milk and blood. In harmony with the hypothesis advanced, urea and chlorin appeared in increased amounts in both blood and milk, while no increase in calcium could be detected.

Some human digestion experiments with raw white of egg, M. S. ROSE and G. MACLEOD (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 83-88).—Digestion experiments were conducted on 10 subjects, all healthy young women, who took daily from 10 to 12 whites of eggs as a part of a simple mixed diet of which the egg whites contributed 48 out of a total of 60 gm. of protein. The experiments were divided into three groups, one in which the raw egg whites were taken thoroughly beaten, one in which they were taken in their natural state, and one in which half were beaten and half were unbeaten. In each group a 3-day period in which the eggs were eaten cooked was followed by a period of the same length in which the eggs were taken raw, as described above.

In no case was there any sign of indigestion, although one or two subjects found the raw eggs slightly laxative. The cooked eggs were uniformly well digested, the average coefficient of digestibility being 86 per cent. On the whole the raw whites were also well utilized, the average coefficient being 80 per cent. The absorption appeared to vary with the method of preparation, being less for raw egg whites taken in their natural state than when beaten light.

The authors conclude that "it seems unnecessary to emphasize the difference between raw and cooked eggs if the raw eggs are beaten."

The hydrolysis of sucrose in the human stomach, R. M. HILL and H. B. LEWIS (*Amer. Jour. Physiol.*, 59 (1922), No. 1, pp. 413-420).—The question of

the extent of the hydrolysis of cane sugar in the stomach was studied *in vivo* by the fractional method of analysis of the gastric contents following the ingestion of considerable amounts of sucrose, and *in vitro* by a study of the action on sucrose of gastric juice withdrawn from the stomach 40 minutes after an egg-white test meal. In the latter case one sample of the juice was heated to boiling and cooled before the addition of the sucrose, one was neutralized, and another was used as obtained.

The results in both the *in vivo* and *in vitro* experiments showed that any hydrolysis of sucrose which takes place in the stomach may be explained solely by the action of the hydrochloric acid present and varies with the concentration of the acid. "The inversion under normal conditions in man is too slight to be of significance, since carbohydrates leave the stomach too rapidly to permit of prolonged action of the acid. It has not been possible to demonstrate the presence of an active sucrase in gastric contents, in spite of the fact that intestinal regurgitation had occurred in many cases, as evidenced by the presence of bile."

The metabolism of sulphur.—IV, The oxidation of cystin in the animal organism, H. B. LEWIS and L. E. ROOR (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 303-310).—To determine some of the factors involved in the oxidation of the sulphur of the cystin molecule in the animal organism, in continuation of the study previously noted (E. S. R., 43, p. 663), the phenyluramino derivative of cystin was prepared and its behavior studied in the organism of the rabbit. The animals were kept on a diet of milk and cane sugar supplemented in some cases with oats. The phenyluraminocystin was suspended in water and sufficient sodium hydroxid added to dissolve it completely. This solution, furnishing in most cases 0.1 gm. of the phenyluraminocystin, was either injected subcutaneously or fed through a gastric sound with a portion of the day's allowance of milk. The urine was collected and tested for total and SO_4 sulphur and the unoxidized sulphur determined by difference.

It was found that the sulphur of the phenyluraminocystin, when administered subcutaneously, was eliminated as extra unoxidized sulphur, while cystin under the same conditions led to no increase in the unoxidized sulphur content of the urine. When fed, a limited oxidation of the sulphur fraction of phenyluraminocystin resulted, although the greater part of the sulphur administered was in this case also recovered in the unoxidized sulphur fraction. "Since uramino acids are not broken down in the organism, these results are believed to indicate that the oxidation of the sulphur of the cystin molecule is connected with the process of deamination or the oxidation of the deamination products."

An explanation for the increase in oxidation brought about by muscular work, W. E. BURGE and J. M. LEICHSNERING (*Amer. Jour. Physiol.*, 59 (1922), No. 1, pp. 290-293, figs. 2).—The catalase content of the blood of rabbits was determined before, immediately after, and 2 hours after a 5-minute period of running in a treadmill. The data reported indicate a marked increase in the blood catalase immediately after this exercise, with a return to normal after the subsequent rest. "The increase in oxidation brought about by muscular work is attributed to the increase in catalase, and the decrease in oxidation with subsequent rest is attributed to the diminution in this enzyme."

The vitamin content of microorganisms in relation to the composition of the culture medium, C. ELJKMAN, C. J. C. VAN HOOGENHUIJZE, and T. J. G. DERKS (*Jour. Biol. Chem.*, 50 (1922), No. 2, pp. 311-314).—Evidence is presented which leads the authors to conclude that the yeast cell is not able to synthesize the antineuritic vitamin, but has the power to remove it from the culture medium and to "regenerate it after it has been denatured by heating." This conclusion is drawn from the observation that baker's yeast, cultivated at

27° C. in a synthetic vitamin-free medium, had no curative properties for polyneuritic fowls, while the same species of yeast grown in an aqueous solution of rice polishings and then carefully washed free of the solution had curative properties even when the solution of rice polishings had previously been heated for one hour in the autoclave at 120° to destroy the antineuritic vitamin.

Similar results were obtained with *Saccharomyces* isolated from brewer's yeast. To determine whether the process by which the yeast cell obtains the vitamin from the culture medium is one of adsorption, yeast was shaken for half an hour at a low temperature in a vitamin-containing beer wort. The yeast, after being separated from the medium by centrifuging and washing, showed no curative effect for polyneuritic fowls. It is concluded that the vitamin is not taken up by the yeast by the process of adsorption but by a slow process of resorption. The investigation is thought to afford further evidence that the antineuritic vitamin and the growth-promoting vitamin B are not identical. It is also noted that *Bacillus coli communis*, after having been cultivated in a medium containing the antineuritic vitamin, does not possess antineuritic properties.

The rôle of vitamins in the chemistry of the cells, W. R. HESS (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 117 (1921), No 5-6, pp. 284-308, pl. 1).—This paper reports the results of an examination of the tissues of healthy and polyneuritic pigeons with respect to the degree of their oxidative processes. The method employed depended upon the reduction by the surviving tissue of *m*-dinitrobenzol to *m*-diphenylhydroxylamin with the production of a yellow color, depending in intensity upon the available oxygen in the tissues. The pigeons were decapitated, the blood washed out with ice-cold Ringer's solution to prevent enzym action, and the different tissues then cut into small pieces and suspended in 1-gm. amounts in 10 cc. of Ringer's solution. To each tube 0.1 gm. of *m*-dinitrobenzol was added, nitrogen was passed through to exclude the air, and the tube then heated in the water bath at 40° C. for one hour. The solution was finally centrifuged and the color determined by a photometric method.

Oxidative processes were found greatly reduced in the tissues of the polyneuritic pigeons examined as compared with healthy or cured pigeons.

The author concludes that vitamin B serves as a catalytic agent to stimulate the oxidative processes of the tissues, and that this explains all of the symptoms of beriberi. To confirm this hypothesis healthy pigeons were injected intramuscularly with doses of from 0.25 to 0.45 gm. of potassium cyanid per 100 gm. of body weight, this substance being known to depress the oxidative functions of the cell in concentrations which have no action on the transmission of oxygen to the blood. It is stated that all the symptoms of avian polyneuritis were thus produced.

B-vitamin and pigeon beriberi, W. H. DE WYSS (*Lancet* [London], 1922, I, No. 2, pp. 100, 101).—A brief review is given of the above paper by Hess with a view to refuting the conclusions of Wright (E. S. R., 46, p. 808) that the symptoms of B-vitamin deficiency are due to intestinal stasis brought about by the absence of this vitamin.

B-vitamin and pigeon beriberi, S. WRIGHT (*Lancet* [London], 1922, I, No. 6, p. 297).—In reply to the above note, the author points out that the intestinal phenomena mentioned in the report of his investigation can be noted when the animal appears to be otherwise in perfect health, and can not, therefore, be regarded as part of a general depression of the tissues throughout the body. The diminution in the oxidative powers of the tissues of animals in an advanced stage of beriberi is considered a secondary phenomenon.

Beriberi: Some facts and the possible hypothesis, T. G. NI (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 6, pp. 340-348).—This is a general discussion of beriberi, especially from the point of view of its occurrence in China and superstitions in that country concerning its etiology. The fact that in 1916 there were about 200 beriberi patients in the Chekiang Army Hospital, while no beriberi cases appeared in the school hospital in the same city, is explained on the ground that the vitamin content of the army rations would have sufficed for civilian life, but that the increased muscular work necessitated a larger vitamin supply. It is also suggested that mental strain may increase the vitamin metabolism. It is noted in conclusion that beriberi may appear before evidences of a general nutritional breakdown and vice versa. A list of 50 references to the literature, covering chiefly the early work on beriberi in the Far East, is appended.

The effect of vitamin deficiency on various species of animals.—II, Observations on the comparative vitamin A requirement of rabbits, rats, swine, and chickens, V. E. NELSON, A. R. LAMB, and V. G. HELLER (*Amer. Jour. Physiol.*, 59 (1922), No. 1, pp. 335-345, figs. 5).—Continuing the investigation previously noted (*E. S. R.*, 43, p. 369), rabbits have been compared with rats as to their requirements of vitamin A by the use of a ration consisting of commercial casein 20, dextrin 70, salts 5, wheat embryo 5, and alfalfa meal 25 parts. The alfalfa meal was extracted with hot alcohol for 96 hours to remove vitamin A, but the casein was not purified. This diet proved capable of supporting slow growth in rats for 2 or 3 months, but rabbits varying in age from 3 to 8 weeks developed xerophthalmia in from 2 to 8 weeks, depending upon the age of the animal at the beginning of the experiment, and died in from 2 to 3 months.

Another ration consisting of oats 60, gelatin 10, agar 5, salts 5, dextrin 20, and extracted alfalfa 20 parts produced a chronic form of xerophthalmia in rabbits.

Attempts to produce scurvy in rabbits by the use of various rations deficient only in vitamin C were unsuccessful. Attention is called, however, to a curious paralysis in the hind legs of rabbits fed certain cereal rations, particularly corn or oats supplemented by common salt and calcium carbonate and with or without butter fat.

To compare the vitamin A requirement of growing pigs, rabbits, and rats, the following ration was used: White corn 55, linseed meal 22, ground oats 15, tankage 5, and salt mixture 3 parts. A sow was fed this ration during the gestation and suckling period. Four pigs were farrowed, 3 of which lived but remained unthrifty and grew slowly. No signs of eye trouble were observed at any time, but on supplementing the ration of one of the pigs with an allowance of about 10 gm. of butter fat rapid improvement in condition resulted. The same ration when fed rabbits caused xerophthalmia and death in one case after 6 weeks and in another case slight xerophthalmia, which was cured by the addition of 5 per cent of butter fat to the ration. Four rats on the same ration grew fairly well to maturity, but the young which were born were not suckled and died in a few hours. The authors conclude that the pig may be classed with the rat in requiring less vitamin A than the rabbit. In preliminary experiments with chickens, soreness of the eyes developed in only one case. "Whether this is due to a similarity to the rat in vitamin requirement, to a nonsusceptibility to this disease, or to other difficulties which characterize the chicken as an experimental animal, we are not yet prepared to state."

A note on the presence of *Bacillus botulinus* type A in the excretions of poliomyelitis patients, R. GRAHAM and E. BARGER (*Ill. Univ. Bul.*, 19 (1921).

No. 7, pp. 23, figs. 16).—The bacteriological examination of the feces and urine of a large number of cases of poliomyelitis during the convalescent period has revealed the presence of *B. botulinus* type A in six instances. The organism was recovered from the urine in five cases and from the feces in one. The evidence on which these findings are based is given in detail in three of the cases.

"The fact that *B. botulinus* type A has been encountered in the excreta of six convalescent poliomyelitis patients suggests the advisability of continuing the investigations until the saprophytic and toxicogenic character of this micro-organism in nature is definitely established, with special reference to its presence in the excretions of normal children and of patients suffering from a paralytic syndrome."

Studies on the paratyphoid enteritidis group.—VII, Enteric infection ("food poisoning") due to tapioca pudding contaminated with *Bacillus cholerae suis* (*B. suipestifer*), C. Krumwiede, D. J. Provost, and G. M. Cooper (*Jour. Med. Research*, 43 (1922), No. 1, pp. 53-59).—The history is given of an outbreak of food infection in a family of two adults and three children, one a breast-fed infant of 5 weeks. From the liver of the one fatal case (one of the adults) and from a tapioca pudding, which was apparently the source of infection, were isolated paratyphoidlike strains which proved to be *B. cholerae suis* (*suipestifer*). That this organism was not present in a living condition in the other foods as served is indicated by the fact that one of the family who ate of every other food than the tapioca pudding did not become ill. The most probable mode of infection of the pudding appeared to be from pork products (frankfurters and pork chops) which were handled during the preparation of the meal. The fact that the organism could not be recovered from the pork is attributed to its destruction by heat in cooking.

ANIMAL PRODUCTION.

[**Animal husbandry experiments**], F. A. Hays (*Wyoming Sta. Rpt. 1921*, pp. 121, 122, 123).—In a study of home-grown feeds for range steers, 36 2-year-old grade Hereford steers were divided into 4 lots for the test, which lasted 98 days. The feeds were as follows: Lot 1 native hay and cottonseed meal; lot 2 native hay and old process linseed meal; lot 3 native hay half feed, cottonseed meal, and a full feed of sunflower silage; and lot 4 native hay half feed, cottonseed meal, and a full feed of oat-and-pea silage. The average daily gains made during the feeding period were for lot 1 1.63 lbs., lot 2 1.8, lot 3 1.53, and lot 4 1.7 lbs. The sunflower silage had been badly frozen in the field before harvesting, and therefore was not of as good quality as might be expected. The feed costs per 100 lbs. of gain were reported to be as follows: Lot 1 \$18.71, lot 2 \$30.83, lot 3 \$21.40, and lot 4 \$19.31.

In comparing native feeds for fattening lambs, four lots of 25 lambs each were fed as follows for 70 days: Lot 1, alfalfa hay full feed and cracked corn; lot 2, alfalfa hay one-quarter feed and mixed silage (mostly oat-and-pea) full feed, and cracked corn; lot 3, alfalfa hay one-half feed, sunflower silage full feed, and cracked corn; and lot 4, alfalfa hay one-half feed, oat-and-pea silage full feed, and cracked corn. The conclusions obtained from this experiment were that the ration of lot 1 was very efficient, alfalfa was probably a more economical source of protein than cottonseed meal, sunflower silage and oat-and-pea silage were found to have about the same feeding value per pound, and that there would probably be no advantage in replacing more than half of the hay by silage.

In a study of the effects of heavy silage feeding on pregnant ewes, 3 lots were fed as follows: Lot 1, full feed of alfalfa hay and $\frac{1}{2}$ lb. of grain; lot 2, one-half feed of alfalfa hay, half feed of oat-and-pea silage, and $\frac{1}{2}$ lb. of grain; and lot 3, full feed of oat-and-pea silage and $\frac{1}{2}$ lb. of grain. The daily gains by the ewes were found to be proportional to the hay feed, but there was no detrimental effect shown on the lambs in any of the groups.

A grain mixture consisting of 25 per cent rolled barley, 50 per cent hominy feed, 10 per cent middlings, and 15 per cent meat meal tankage was fed to 3 lots of pigs, but in lot 1 it was fed dry, in lot 2 mixed with an equal weight of cold water, and in lot 3 mixed with an equal weight of warm water. The results of the test showed a slight advantage from moistening the feed, but in this test, as well as another similar one, no advantage was obtained from warming the water.

A chemical study of broom corn and broom corn silage, C. T. DOWELL and W. G. FRIEDEMANN (*Oklahoma Sta. Bul. 135 (1921), pp. 3-7*).—The composition and coefficients of digestibility of broom corn seed (E. S. R., 45, p. 373), broom corn stover, and broom corn silage as determined with one sheep are reported as follows:

Composition and coefficients of digestibility of broom corn.

Broom corn product.	Composition						Coefficients of digestibility					
	Water	Protein	Fat	Fiber	N-free extract	Ash	Dry matter	Protein	Fat	Fiber	N-free extract	Ash
	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct	Per ct
Broom corn seed	10.06	13.37	3.64	9.04	59.62	4.27	33.9	91.9	69.2			
Broom corn stover	7.17	8.60	1.46	38.99	36.96	6.82						
Broom corn silage	80.00	1.30	.23	6.82	9.77	1.85	51.5	36.4	68.9	49.9	55.3	48.5

Analyses were also reported for prussic acid, ash constituents, sugars, alcohols, acidity, and tannins which were found for the broom corn and broom corn silage.

Feeding value of sunflower silage, H. N. VINALL (*U. S. Dept. Agr. Bul. 1045 (1922), pp. 19-29*).—In this discussion a review is given of the more recent literature dealing with the composition, digestibility, palatability, acidity, and feeding tests with sunflower silage for dairy and beef cattle, sheep, and swine.

Sunflowers for silage in Ohio, L. E. THATCHER (*Ohio Sta. Mo. Bul. 7 (1922), No. 3-4, pp. 42-49, figs. 2*).—Results with sunflowers as silage at the station for 1920-21 are reported. Under Ohio conditions sunflowers were not found as satisfactory as corn, since they were more difficult to harvest, not as much nutrients was raised per acre as with corn, and they were found somewhat unpalatable as a feed. Notes on methods of sunflower culture, reports of trials by farmers, and analyses of fresh sunflowers, sunflower silage, and corn are also given.

Sunflower silage (*Nevada Sta. Rpt. 1920, pp. 13, 14*).—In a study by C. E. Fleming, undertaken because much silage spoils in western Nevada, a $3\frac{1}{2}$ -ton silo was filled with sunflower silage which had standard dairy starter sprinkled on it in an endeavor to control the fermentation by making it uniform. When

the silo was opened in February the silage was very fresh and of uniform quality.

A study of the composition of official samples of feeding stuffs and mixtures collected in 1920, L. L. VAN SLYKE (*New York State Sta. Bul. 482* (1920), pp. 23).—The previous policy of reporting the analyses of all feeding stuffs analyzed during the year was changed for the feeding stuffs collected in 1920 to consist only of the summary of the more important facts to be derived from the study of the feeding materials analyzed during the year. In this report the feeds which were analyzed during the year are defined according to the definitions of the Association of Feed Control Officials of the United States, and the low, high, and average analysis of the protein, fat, and fiber is given for the samples of each of the following feeds which were collected: Alfalfa meal, meat scrap and meal, meat and bone scrap and meal, digester tankage, buckwheat products, coconut meal, corn feed meal, corn gluten feed, corn, oats, and oat by-products, cottonseed meal, cottonseed feed, dried beet pulp, hominy feed, linseed meal, oat products, rye products, wheat bran, wheat middlings, wheat bran and wheat middlings, wheat bran and red dog flour, wheat bran, middlings and red dog flour, wheat middlings and red dog flour, and wheat and rye products.

The mixed feeds analyzed were divided into four classes: Compounded feeds, compounded feeds with molasses, poultry feeds, and calf and pig meals. A list of the ingredients of these feeds, with the number of times which they were found in the mixed feeds of each class, is also given.

Genetical and cytological proof of nondisjunction of the fourth chromosome of *Drosophila melanogaster*, C. B. BRIDGES (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 7, pp. 186–192, fig. 1).—The author cites evidence of the discovery of a mutant type of *D. melanogaster* in which one of the small round chromosomes is lacking. These mutants differ in various characters such as smaller size, shorter bristles, low productivity, frequent sterility, heavy mortality, delayed hatching, etc. Cytological examinations show but one round chromosome, and inheritance studies bear out the fact that one of the fourth chromosomes is missing. This gives proof that the characters attributed to the fourth chromosome are carried by the small round chromosomes.

The origin of variations in sexual and sex-limited characters, C. B. BRIDGES (*Amer. Nat.*, 56 (1922), No. 642, pp. 51–63, figs. 7).—Due to the manner in which genes may modify characters, they are classified as plus and minus modifiers by the author. The loss of one chromosome or a portion of it would remove more plus (or more minus) modifiers which would change the control characters in the opposite direction by the remaining modifiers. In studying the loss of one of the small round chromosomes of *Drosophila* reported above, it was found that part of the characters showed evidence of plus modification whereas others showed minus modification.

When an individual with only one round chromosome is mated with a normal individual, the offspring are haploid and normal for this condition in a 1:1 ratio. This is shown to be comparable with the sex chromosomes in which the haploid number occurs in the male and the diploid number in the female. The belief is expressed that haploidy for autosomes is much more numerous than for the sex chromosomes and brings about greater changes, which may be lethal in some cases. Two X-chromosomes produce females normally, but triploid females may produce offspring which have 2 X-chromosomes and yet are not females. The cause of this seems to be attributed to the fact that they have 3 autosomes, which the author states are thus proved to play a positive rôle in the production of sex, thus the sexes are due to the action of two opposed sets of genes which are not equally effective, since the female ten-

dency genes outweigh the male tendency genes. In other words, the X-chromosomes have a female producing tendency, whereas the autosomes or especially the small round pair tend to produce males. When the number of X-chromosomes or female tendency genes is lowered by 1 X, the normal haplo-X male results. Intersexes result from nondisjunction in such ratios as 2 X-chromosomes to 3 sets of autosomes. The intersexes divide themselves into those which tend toward males and those which tend toward females with much overlapping between. This is explained as due to the wide fluctuations of the characters due to environment which occurs where the ratios are so near alike.

The phenomenon of intersexuality has a reciprocal phase in the production of supersexes, which have been identified in nondisjunction strains in which superfemales, diploid individuals having an extra X-chromosome ($2n+X$), and also triploid individuals with only 1 X-chromosome ($3n-2X$), occur. The supermales and superfemales are both sterile and readily identified. Diagrams of individuals of the intersexes and supersexes, as well as drawings of their chromosomes, are included.

Heredity in wasps, P. W. WHITING (*Jour. Heredity*, 12 (1921), No. 6, pp. 262-266, figs. 3).—In studying the methods of inheritance of certain mutations in a parasitic wasp, *Hadrobracon brevicornis*, it was found that the males are strictly haploid, whereas the females are diploid for their chromosome numbers. Virgin females were found to produce only males. Mutations of the wing venation, eye color, and appendages were mainly considered in the inheritance studies which gave proof of the haploid condition of the males.

The systematic improvement of our classes of animals, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 47 (1921), Spanish ed., pp. 16, pls. 18, figs. 2).—This is a discussion of the improvement of farm animals in Porto Rico by means of purebred sires. Lists of the more important breeds of horses, cattle, sheep, goats, swine, and poultry are also given, as well as pictures from photographs taken by F. Sein, Jr., of some Porto Rican live stock.

Stock breeding in Morocco, T. MONOD (*Compt. Rend. Acad. Agr. France*, 6 (1920), No. 36, pp. 873-879).—The general conditions of stock breeding in Morocco are discussed, together with the more common difficulties experienced, with explanations of how some of them have been remedied by better education of the natives and the establishment of free veterinary service.

Result of a calf-raising trial, H. E. McNATT (*Washington Sta., West. Wash. Sta. Bimo. Bul.* 9 (1922), No. 7, pp. 118-123).—In an investigation to determine whether a small allowance of whole milk supplies sufficient vitamins for growth in calves when supplemented with suitable rations of concentrates and roughage and to determine what concentrates may be best used to supplement such small amounts of milk, 12 grade Holstein-Friesian heifers were used in a test which began on July 27, 1921. At this time the calves were from two to three weeks old and were each getting 10 lbs. of milk per day. The calves were separated into three groups of 4 calves each. All calves were rapidly reduced to 2 lbs. of whole milk per day and put on the following grain mixture: Group 1, 20 lbs. finely ground corn meal, 20 lbs. red dog flour, 20 lbs. soy-bean meal, 15 lbs. linseed oil meal, 25 lbs. pulverized dried skim milk, and 7 oz. salt; group 2, 30 lbs. finely ground corn meal, 30 lbs. red dog flour, 35 lbs. soy-bean meal, 5 lbs. linseed oil meal, and 7 oz. salt; and group 3, 40 lbs. finely ground corn meal, 35 lbs. wheat bran, 15 lbs. soy-bean meal, 10 lbs. linseed oil meal, and 7 oz. salt.

The grain was fed in the milk as a slop, the amount being determined by the appetite of the calves. Hot water was used to prevent its being too

thick as the amount of milk was reduced and the amount of grain increased. Alfalfa hay was fed ad libitum after one month of age.

The calves in group 1 started off well, but at the end of four weeks they were unthrifty and the powdered skim milk was replaced by warm pasteurized skim milk. One calf died of acute indigestion at about this time, and it was later found necessary to turn the rest out and change the feed in order to save them. Due to the unthrifty condition of group 2 at the end of six weeks their ration was modified so that they received the same ration as group 3, together with a more liberal feed of skim milk. The condition of these calves then improved rapidly. Group 3 took to the grain ration readily and kept in a thrifty condition, making steady gains throughout the test. The bulky ration, however, tended to make them a little pot-bellied. The calves in this group averaged 1.5 lbs. of grain per day, with an average feed cost per calf of \$19.64 to raise them to 5½ months of age.

Feeding yearling steers, F. A. HAYS (*Wyoming Sta. Circ. 17 (1922), pp. 4*).--This is the report of an experiment as to the costs of wintering yearling steers under different conditions, with a study of the after effects of these methods of wintering on the summer gains. Two lots of 10 grade Hereford steers were used in the test. One lot was turned on a fenced range and received an average daily feed of 9 lbs. of native hay, 1 lb. of alfalfa hay, and 1 lb. of cottonseed cake. The other steers were placed in a dry lot on a daily ration of 4.2 lbs. of alfalfa hay, 4 lbs. of native hay, and 33.5 lbs. of oat-and-pea silage. The two lots were kept on these rations from November 29, 1916, to June 6, 1917, at which time the range lot was found to have made an average gain of only 1 lb. per steer for the 180 days. The steers in the dry lot, however, made an average gain of 0.87 lb. per day.

The two lots were then turned together on range pasture until December 1, 1917. It was found that during this time, the range steers gained 1.30 lbs. per day as compared with 0.85 lb. per day for the steers that had been fed in the dry lot. A summary of the two periods showed that the range steers had made an average gain of 0.68 lb. per day, as compared with 0.86 lb. per day for the steers wintered in the dry lot. The cost per 100 lbs. of gain was found to be \$8.10 and \$8.48, respectively, showing that while the range steers made practically no gains during the winter they nearly caught up with the others by making better gains during the summer which were put on at a lower cost per pound.

[Pasture trials], M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1920, p. 26*).--Another year of the summer pasture trials with heifers, previously reported (*E. S. R., 43, p. 671*), is given. The following table furnishes a complete summary of the five years' work:

Gains and maintenance of heifers on stump land pasture.

Year.	Continuous pasture.		Number of cattle.	Average age of cattle.	Average gain.	
	Began.	Ended.			Total.	Daily.
				Months.	Pounds.	Pounds.
1916.....	June 12	Oct. 17	10	17.2	103.6	1.59
1917.....	June 1	do.			74.0	.53
1918.....	do.	Oct. 18	6	19.0	175.0	1.35
1919.....	June 3	Oct. 27	4	10.5	172.0	1.18
1920.....	May 25	do.	9	15.5	168.0	1.08
Average.....	June 2	Oct. 19	8.25	15.5	138.5	1.145

Winter feeding experiments [with sheep], 1918-19, D. L. McMILLAN and G. W. PUTNAM (*Michigan Sta. Spec. Bul. 110 (1921), pp. 7-9*).—A feeding test is reported with 70 ewe lambs in which barley and corn were compared. The rations fed consisted of 3 parts of corn or barley and 1 part of oats, with a few roots and clover hay. For the 75-day feeding period the barley lot gained an average of 0.156 lb. per day, whereas the corn lot gained 0.1386 lb. per day.

Four lots of 30 breeding ewes each received $\frac{1}{4}$ lb. of oats daily and all the hay they would eat, with the following supplements: Lot 1 silage, lot 2 roots, lot 3 bran, and lot 4 dried beet pulp. A fifth lot received only hay as a check ration. During the 75-day feeding period the average daily gains made by the ewes were for lot 1, 0.095 lb.; lot 2, 0.16; lot 3, 0.097; lot 4, 0.11; and lot 5, 0.018 lb. The cost of the rations per ewe per day were, respectively, 3.5, 4, 5, 5, and 4.5 cts. It was concluded that from $1\frac{1}{2}$ to $1\frac{3}{4}$ lbs. of silage or roots per day could well be added to the winter ration of breeding ewes.

Breeding earless sheep, E. G. RITZMAN (*New Hampshire Sta. Sci. Contrib. 17 (1921), pp. 238-240, figs. 3*).—This is a reprint of the work previously reported (E. S. R., 45, p. 170).

Direct costs on horses, H. M. ELLIOT (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 94, 95*).—From data collected on 23 farms, it is shown that the cost of keeping a horse is practically equal to the cost of feed and bedding, since the other costs such as depreciation, etc., are equaled by the returns from manure and horse sales. The cost of keeping a horse one year according to these data was \$90.59.

Fundamentals in poultry breeding, J. H. ROBINSON (*Quincy, Ill.: Rel. Poultry Jour. Pub. Co., 1921, pp. 160, pl. 1, figs. 580*).—This is a popular presentation of the principles of breeding as applied to poultry. The book is profusely illustrated, containing many of the same cuts as appeared in the work previously reported (E. S. R., 46, p. 875).

Advanced registry poultry breeding project at Cornell University, G. F. HEUSER (*Poultry Sci., 1 (1922), No. 3, pp. 83-86*).—This is a description of the manner in which the advanced registry poultry breeding project at Cornell University was conducted from December 1, 1920, to November 30, 1921. Of the 354 birds entered, 76 qualified for the Cornell Advanced Registry and the American Association of Poultry Instructors and Investigators Registry Record of Performance by laying over 180 eggs. The relation between the number of eggs laid by the birds and the egg size is shown for the month of May.

Mineral supplements to rations for chickens: Corn meal and soy bean meal, D. C. KENNARD, R. C. HOLDER, and P. S. WHITE (*Poultry Sci., 1 (1922), No. 3, pp. 65-74*).—This is the report of an experiment to develop a simple salt mixture for correcting the mineral deficiency of a ration of corn meal and soy bean meal for fleshing chickens. Barred Rock cockerels and hens were used in the test.

The results indicated that soy beans, with 2 per cent of the ration a mineral mixture of bone ash, calcium carbonate, and sodium chloride (6:2:2), proved as effective or nearly as effective as a supplement to corn for fattening chickens as meat scrap or buttermilk. The authors emphasize the fact that the superior value of animal protein for poultry may not lie in the character of the protein itself as much as in the mineral or vitamin content.

Farm flock demonstrations (Indiana Sta. Rpt. 1921, pp. 31, 32, figs. 2).—For studies in farm flock management 227 Single Comb White Leghorns were kept over as hens and divided into one flock of early molters and one of late

molters. The early molters laid an average of 102.76 eggs and the late molters 119.62 eggs each. The hens did not prove as profitable as yearlings as they did in their pullet year.

Temperature experiments in incubation (*Indiana Sta. Rpt. 1921, pp. 30, 31, fig. 1*).—A temperature of 101 or 102° F. for the incubator seemed to give a better hatch than 100 or 103° in two sets of incubation experiments, the average number of chicks hatched from 150 eggs being, respectively, 109.5, 104.5, 96.5, and 87.5.

Tenth annual international egg-laying contest at Storrs, Conn., W. R. KIRKPATRICK (*Poultry Sci., 1 (1922), No. 3, pp. 87-89*).—In this contest, conducted by the Connecticut Agricultural College, the winning pen of 10 birds were White Wyandottes that produced 2,234 eggs during the year. A list of the winners of previous years is included, as well as the average production of the different breeds entered and the 20 highest pens in the 1921 contest.

Latest facts from New Jersey's egg-laying and breeding contests, R. R. HANNAS (*Poultry Sci., 1 (1922), No. 3, pp. 75-82*).—The original report of this work has been previously noted (E. S. R., 46, p. 877.)

New York State egg-laying contest at Farmingdale, L. I. (*Poultry Sci., 1 (1922), No. 3, pp. 89-90*).—This is the report of the first New York State egg-laying and poultry-breeding contest at Farmingdale, L. I. A total of 139,477 eggs were laid, or an average of 152.11 eggs per bird. The highest individual producer was a Single Comb White Leghorn that laid 262 eggs.

DAIRY FARMING—DAIRYING.

Feeding dairy cattle, T. M. OLSON (*South Dakota Sta. Bul. 195 (1922), pp. 357-372, figs. 2*).—This bulletin discusses the general principles of feeding dairy calves, cows, and bulls. Sample rations were also suggested for young and mature bulls, dry cows, and milching cows with and without silage.

Sweet clover pasture, O. E. REED and J. E. BURNETT (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 77-79, figs. 2*).—Four cows, receiving approximately 1 lb. of grain for 4 lbs. of milk produced and pastured on 1.46 acres of sweet clover for 177 cow days, maintained their weight and produced 6,088.6 lbs. of milk and 201 lbs. of fat. At the start of the test on June 4 the clover was from 37 to 42 in. high, and another portion yielded 2.75 tons of hay to the acre. Over 40 per cent of the plants were in bud and nearly 15 per cent were in bloom at that time. When first turned on the pasture three of the cows did not eat the clover readily, but they soon relished it. No signs of bloating were noted throughout the experiment.

Sunflower silage v. pea-and-oat silage, D. L. McMILLAN and G. W. PUTNAM (*Michigan Sta. Spec. Bul. 110 (1921), p. 7*).—Previously reported (E. S. R., 45, p. 275).

A case of twinning in dairy cattle, C. C. HAYDEN (*Ohio Sta. Mo. Bul., 7 (1922), No. 3-4, pp. 54-57, figs. 4*).—A cow in the station herd is reported as having dropped five sets of twins out of seven times calving. Twinning has also been rather common in other closely related cows in the herd. The possibility of establishing a family of cows which would produce a high percentage of twins is suggested, but it is pointed out that of the 9 sets of twins recorded 6 sets were male and freemartin and 3 were males.

Studies in milk secretion.—XII, Transmitting qualities of Holstein-Friesian sires for milk yield, butter-fat percentage, and butter fat, J. W. GOWEN and M. R. COVELL (*Maine Sta. Bul. 301 (1921), pp. 253-308, figs. 2*).—This is the twelfth paper of the series of studies previously reported (E. S. R., 46, p. 173), and classifies 111 Holstein-Friesian bulls, having 2 or more

daughters with 365-day records whose dams also had 365-day records, according to the increases in the milk production, fat production, and fat percentage which have been produced by these daughters over that of their dams. This is thus used as a measure of the bull's capacity to transmit high production to his daughters. The data used were obtained from volumes 13-32 of the Holstein-Friesian Advanced Register. The production records were corrected to 8 years of age, as was done in the earlier work.

The dams and daughters were divided into 4 lots of equal size (quartiles) according to their records. The quartiles were designated by A, B, C, and D from the highest to the lowest production. In studying the records of each bull it was noted how many of the daughters were in a higher or lower quartile than the dam for milk and fat production and fat percentage. The tables listing the quartile changes of the daughters of each bull also include the ranking of the bulls with the ones that have made the greatest increase of the daughters' production over dams at the top, the number of pairs of dams and daughters for each bull, and the average net change (either increase or decrease) that occurred in the production.

Of the 111 sires, it was found that 12 increased and 3 decreased production by two times the probable error in case of milk production, whereas in the case of butter-fat percentage 15 increased and 7 decreased.

A discussion is given of the 27 sires which were found to increase both milk production and fat percentages as determined by the averages. The increase or decrease in the amount of butter fat produced was dependent upon the above factors and is, therefore, not given the same importance according to classifications, though of course it is one of the main things for which the study is made.

Studies were made of the breeding of the bulls which increased or decreased the percentage of fat and the milk production in which the amount of inbreeding was considered, and tables were prepared of the animals which reappeared in the pedigrees of the superior and the inferior sires. Similar animals and similar types of breeding were found in both cases, so that no conclusions as to difference in breeding as affecting the different sires' influence on production could be drawn. Since the pedigrees of the inferior and superior sires were so much alike, the authors believe that much caution should be used in giving value to a pedigree because of an outstanding animal which may occur back of the second generation.

Studies similar to the above were also carried on with the sons of sires, in which 84 sires having one or more sons with at least 2 daughters that had 365-day records from dams with records were used.

Contribution to the knowledge of the bactericidal properties of freshly drawn cow's milk. W. MEIER (*Beitrag zur Kenntnis der Bakteriziden Eigenschaften der Frischermolkeneen Kuhmilch. Diss., Eidg. Tech. Hochschule, Zurich, 1919, pp. 94; also in Bot. Centbl., Beihefte, 36 (1919), 1. Abt., No. 2, pp. 261-353; also in Centbl. Bakt., etc., 1, 2. Abt., 51 (1920), No. 16-20, pp. 424-427*).—Experiments are reported dealing with the bactericidal property of cow's milk. This property was measured by the reduction in the number of bacteria in milk during the first few hours after it was drawn. A brief summary of the experiments carried on and the results obtained is as follows:

In 4 samples of milk from individual cows, it was found that during the first 4 hours after milking the bacterial counts decreased by 25 to 70 per cent and after 7 hours from 3 to 85.7 per cent, after which the bacteria increased rapidly. Seven samples of milk from 5 different cows were found to be variable as to the longevity and the amount of their bactericidal properties.

Holding samples of milk of 3 cows at 14° C. (57.2° F.) kept the bacterial count below the bacterial count of the freshly drawn milk, and the maximum reduction in number of bacteria varied from 48.7 to 62.1 per cent which occurred in each case on the fifteenth, fourth, and sixth hours, respectively, for each cow. Holding 7 samples of milk from 5 cows at 18 to 20° showed bacterial reductions of 9.6 to 85.7 per cent, occurring at 4 and at 7 to 8 hours after milking. This indicates that milk held at 14° has a longer bactericidal action than at room temperature.

Holding 7 samples of milk from 7 cows at 30° and at 37° showed that the bactericidal properties were of shorter duration than at 18 to 20°. The maximum duration of the bactericidal action of milk was found to be as follows: At 14° 21 hours, at 20° 18 hours, at 30° 5 hours, and at 37° 3 hours. The maximum and minimum intensities of the action at the different temperatures, as determined by the percentage reduction in bacterial count was as follows: At 14° 62 and 48.7 per cent, 20° 85.7 and 9.6 per cent, 30° 52 and 3.2 per cent, and 37° 30 and 13.7 per cent.

Experiments were also carried on with milk produced under practically aseptic conditions by thoroughly cleaning the udder and disinfecting it with alcohol, as well as the milker's hands, and drawing the milk directly into sterile flasks. This milk, when held at 13, 30, and 37°, showed practically the same bactericidal action as was obtained with ordinary milk except that the bacterial count was much lower at the start.

In other experiments milk was drawn from each quarter and samples were taken of the first 100 cc. drawn, the middle 100 cc. drawn, and the last 100 cc. drawn. There seemed to be some variation in the bactericidal powers of the milk from the different quarters of the udder, but the general results were uniform. The middle milk seemed to have the greatest power and the first milk next, but in all four cases the results varied, as in one case after 4 hours the bacterial count was +16.6 per cent, whereas after 8, 12, and 15 hours it was -45.2, -54.7, and -40.5 per cent, respectively. In 4 samples from 1 cow the last milk drawn showed no bactericidal power, whereas in 1 sample from another cow the time at which the sample was taken had no influence on its bactericidal property. The author concludes that the portion of the milking makes no difference in the bactericidal property.

In further experiments milk so old that it had lost its bactericidal properties was mixed with fresh milk to see if the bacterial growth would be inhibited. Such was found to be the case. In three experiments milk drawn from 7 cows and kept for 14 hours at 20°, after which different amounts of freshly drawn aseptic milk were added to it, showed a marked bactericidal action of the fresh milk by reducing the bacterial count 10, 20, and 25 per cent when mixed in the ratios of fresh to old milk 1:2, 1:1, and 2:1, respectively, as compared with the bacterial increase of the controls.

Similar work was carried on with milk held at 30°, and similar results were obtained. Sterilizing and pasteurizing milk seems to destroy its bactericidal properties. In experiments with different kinds of bacteria from old milk, manure, and cultures of *Bacterium prodigiosum*, some bacteria were found to be more resistant than others to the bactericidal properties of milk.

In a discussion of the possible origin of the bactericidal action of milk, the following constituents which may be in the milk are mentioned as possible causes: Leucocytes, immune bodies, complements, and antitoxins.

The relation between bacterial counts from milk as obtained by microscopic and plate methods. A. H. ROBERTSON (*New York State Sta. Tech. Bul.* 86 (1921), pp. 3-21, pls. 5).—This is the report of an investigation to study the

average size of groups of bacteria found in market milk, to determine the most frequent ratios between the counts by the microscopic method and the plate method with different incubation procedures, and to show the effect of different incubation periods on the percentage of plate counts that are found to be intermediate between the group and individual microscopic counts.

The samples of milk used in this investigation consisted of fresh unpasteurized milk from the milk supply of Geneva, N. Y. When it was desired to have samples of higher bacterial count than was normally obtained, the milk was held in an incubator for a sufficient time to increase the bacterial count. The plating of samples was done on plain nutrient agar with a pH reaction of 6.8 to 7. Dilutions of milk in plating were made as follows: 1:100, 1:1,000, and 1:10,000, with some higher dilutions for high count samples. Plate counting of 264 samples was made by incubation at 37° C. for 2 days, of 126 samples by incubation for 5 days at 21°, and of 288 samples by incubation for 5 days at 21°, followed by 2 days at 37°. Microscopic counts were of course made on all of these samples either just previous or just after the plating was done. In making the microscopic counts 0.01 cc. of milk was spread over an area of 1 sq. cm. This was then dried, the fat removed by xylol, fixed, stained, and 100 or more fields were counted for the number of individual bacteria, as well as the number of groups of bacteria which were present. The milk was grouped into the following classes according to the bacterial count per cubic centimeter as determined by the microscope: Under 30,000, 30,000 to 200,000, 200,000 to 1,000,000, 1,000,000 to 10,000,000, and over 10,000,000. The average number of bacteria per colony in the above classes of milk were, respectively, 1.9, 6.8, 10.2, 12.8, and 7.8. This agrees very well with the findings of work previously reported (E. S. R., 39, p. 76), i. e., the size of the colonies in Geneva market milk was largest in milk of medium quality (1 to 10,000,000 bacteria).

The most frequent ratio between the individual microscopic counts and the plate counts for the different incubations were found to be as follows: Two days at 37° 4:1, 5 days at 21° 2.5:1, 5 days at 21°, followed by 2 days at 37° 2:1. Evidence of wide discrepancies in counts was shown by curves which were plotted to show the frequency of the different ratios from this work and from the work reported above. With the 7-day incubation the curves were found to be sharper and the modes were more pronounced.

Tables are given showing the relation of the plate count to the microscopic count for individual bacteria and groups of bacteria. The percentages shown for the five different classes of milk in which the plate count falls between the individual and group microscopic count, in which the plate count is more than the individual microscopic count, and in which the plate count is less than the group microscopic count, incubated at 37° for 2 days, showed that 38 per cent of the plate counts were intermediate between the individual and group microscopic as compared with 63 per cent of the samples when the plates were incubated at 21° for 5 days only or with an additional 2 days' incubation at 37°. The plate counts were found to be more than individual counts only in 2, 3, and 4 per cent of the samples, respectively, which was probably due to experimental error. The plate counts were less than the group microscopic counts in 60, 33, and 34 per cent of the cases, respectively.

The author states that this investigation "indicates that approximately one-third of the counts from plates incubated 2 days at 37° are as high as they should be, another third are much too low, and very few are higher than they should be, while the errors in the case of the remaining counts are undetermined because of the lack of a satisfactory standard of comparison."

Frequent reference is made to work previously reported (E. S. R., 43, p. 680).

Does carbon dioxide in carbonated milk and milk products destroy bacteria? M. J. PRUCHA, J. M. BRANNON, and A. S. AMBROSE (*Illinois Sta. Circ.* 256 (1922), pp. 8).—This is a preliminary report of four experiments to determine the influence of carbon dioxide on germ life in carbonated dairy products.

The first two experiments were with ice cream which was frozen in a carbon dioxide atmosphere. In one experiment the bacteria studied were those normally found in ice cream, whereas in the second experiment typhoid bacteria were used. In the third experiment studies were made of the growth of bacteria on agar and in milk in a carbon dioxide atmosphere. In the fourth experiment the growth of bacteria in milk in a carbon dioxide atmosphere under 10, 20, 40, and 60 lbs. pressure was studied. Controls were kept for all experiments. The results of growth were determined from bacterial counts which were made by the plate method. In the first two experiments (ice cream) there was no effect on the growth of the bacteria from the carbon dioxide, as it did not even slow the rate of bacterial growth. In the third experiment growth was inhibited on agar and three cultures were killed, but in milk the bacteria increased in numbers.

In the fourth experiment, while the rate of growth was decreased, especially with a high pressure of carbon dioxide, growth was in no case stopped. In this experiment the untreated milk was found to sour in 30 hours, whereas the milk in the carbon dioxide atmosphere under 10, 20, 40, and 60 lbs. pressure soured in 2, 3, 5, and 9 days, respectively. The conclusion is drawn that carbon dioxide can not be relied upon as a means of insuring the sanitary quality of dairy products, though it may be found to have some commercial advantages.

Milking machines.—VI, **Leakage from the vacuum pipe line into the pail as a source of contamination of milk**, R. S. BREED and J. W. BRIGHT (*New York State Sta. Bul.* 488 (1921), pp. 3-19, figs. 9).—In this, the sixth study of milking machines (*E. S. R.*, 43, p. 679), the danger of contamination of milk by the condensation water from the vacuum pipe line leaking into the pail has been studied. Several experiments were first carried on with a single unit of an inflation teat-cup type of milker, to ascertain if it were possible for foul condensation water from the stanchion hose to pass through the check valve on the pail top into the milk. Such tests showed that this was possible, and in doing so a varied number of bacteria were usually carried with the water and thus made it difficult at least to produce certified or grade A milk because of the increase in bacterial count. Methods of testing the check valves are suggested so that any dairyman may determine if the check valves of his own machine leak. The importance of thoroughly cleaning the check valves, stanchion hose, and vacuum lines is also emphasized.

Creamery inspection in New Jersey, F. C. BUTTON (*New Jersey Sta. Circ.* 129 (1921), pp. 3-16, figs. 3).—This is the annual report of the creamery inspection work in New Jersey for the year ended June 30, 1921, the previous annual report of which was noted (*E. S. R.*, 44, p. 474). The purpose of the creamery inspection work, the duties of the testers, and the results obtained are presented, as well as lists with the names of the licensed testers, persons permitted to weigh and sample milk, and the milk receiving stations purchasing milk on a butter-fat basis, as well as the text of the State dairy inspection law of 1920.

Experiments in ice cream making (*Indiana Sta. Rpt.* 1921, pp. 20, 21).—In studying the cause of sandiness of ice cream, indications are that this defect is due to a crystallization of lactose. This seems to occur when more than 7.25 per cent of lactose or 13.6 per cent of solids not fat are present.

VETERINARY MEDICINE.

[Report on the work of the] health of animals branch, S. F. TOLMIE (*Canada Min. Agr. Rpt.*, 1921, pp. 60-69).—This report, covering the year ended March 31, 1921, deals particularly with the occurrence of and work with infectious diseases of live stock, including glanders, hog cholera, dourine, mange in horses and cattle, bovine tuberculosis, sheep scab, anthrax, and rabies.

The principal stock-poisoning plants of Oregon, W. E. LAWRENCE (*Oregon Sta. Bul.* 187 (1922), pp. 42, pls. 2, figs. 10).—Accounts are given of the more important stock-poisoning plants of Oregon, including the common name, the animals which they affect, extent of the poisoning, symptoms, preventive and remedial measures, etc. A bibliography of about four pages is included.

The death camas species, *Zygadenus paniculatus* and *Z. elegans*, as poisonous plants, C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr. Bul.* 1012 (1922), pp. 25, pls. 3, figs. 5).—Investigations conducted, in continuation of those presented in an account previously noted (*E. S. R.*, 33, p. 177), have shown that the species at that time identified as *Z. venenosus* is not the true *Z. venenosus* but is *Z. gramineus*. Of the other species used, *Z. elegans* and *Z. coloradensis* are so closely allied that they are considered by many botanists as not specifically distinct. There is no question, however, of the specific distinction between *Z. gramineus*, *Z. elegans*, and *Z. paniculatus*, the latter two of which are dealt with in this bulletin. These species, all of which are known popularly under the collective name of "death camas," are so closely allied that they are not likely to be separated by other than one having a fair knowledge of botany. *Z. paniculatus* is the most widely distributed and is the most common form. *Z. elegans* is not so abundant but is the common species on the higher mountain ranges of the West.

The results of feeding experiments, many of the details of which are presented in tabular form, have shown a marked difference in the toxicity of *Z. paniculatus* and *Z. elegans* as compared with the earlier work with *Z. gramineus*, *Z. paniculatus* being about one-third as toxic and *Z. elegans* about one-seventh as toxic as *Z. gramineus*. While *Z. paniculatus* is not so toxic as *Z. gramineus*, it is a distinctly dangerous plant and is the cause of heavy losses of live stock. While *Z. elegans* may poison live stock, it probably does little or no damage under practical range conditions.

Studies of death camas at the Nevada Experiment Station have been noted (*E. S. R.*, 45, p. 782).

An investigation of the causes of "run" pelts in the sweating process, P. H[AMPSHIRE] (*Bur. Bio-Technol., Leeds, Bul.* 2 (1921), pp. 39-49, figs. 6).—This is an account of the injury to hides in England due to a species of nematode that causes a localized breaking down of the hide substance and results in pitting. The conclusions so far arrived at are that the worms are not present in the skins when they are received at the fellmongery, but that they are actually being cultivated in the sweating chambers under optimum conditions.

Studies on the nature of filterable virus and the resistance of fowl-pest virus toward cell-destroying influences (tannins, oligodynamical forces), P. SCHWEIZER (*Arch. Hyg.*, 90 (1921), No. 4, pp. 155-174).—An extensive study of the nature of filterable virus, using fowl-pest virus as the experimental substance, is reported, from which the following conclusions are drawn:

Fowl-pest virus can be completely removed from protein solutions in which it is contained, such as serum or exudates from infected fowls, through total or partial precipitation of the protein with protein precipitants such as tannin

or ammonium sulphate, as shown by the fact that the remaining liquid is avirulent for fowls and the virus can be detected in the precipitate. In the tannin precipitate is found only a small part of the original virus, showing its sensitiveness to destruction as well as adsorption by the tannin. This sensitiveness toward tannin differentiates bacteria from filterable virus and shows the resemblance of the latter to protozoa.

Fowl-pest virus is as sensitive toward oligodynamical action as are the vegetative bacteria, which suggests that the virus consists of cells in the true sense of the word. Toward the action of pure salt solution virus shows as much resistance as do most species of bacteria.

The course of migration of *Ascaris* larvae, B. H. RANSOM and E. B. CRAM (*Amer. Jour. Trop. Med.*, 1 (1921), No. 3. pp. 129-159, figs. 17).—This is a detailed report of investigations conducted, some of the results of which have been given in the account previously noted (*E. S. R.*, 44, p. 778).

In the course of the experiments use was made of about 100 animals, mostly guinea pigs, but also a few rabbits, rats, and mice. Eggs removed from the uteri of gravid female ascarids obtained from the intestines of swine were used exclusively as a source of infestation. These eggs were incubated at room temperature for several weeks in a shallow depth of a 2-per-cent formalin solution contained in Petri dishes. The guinea pigs and rabbits were infested by placing large quantities of the incubated eggs in the back of the mouth by means of a medicine dropper and causing the animals to swallow. The animals were killed by chloroform at various intervals after infestation if they had not already succumbed, and examinations were made for the presence of the larvae in various parts of the body. The results of the examinations for their presence in the portal vein; liver; vena cava; heart (right side); lungs; mesenteric lymph nodes; peripheral lymph nodes, thyroid, and thymus; the abdominal cavity; and the pleural cavity are considered at length under these heads.

The work has clearly demonstrated the passage of the larvae in the portal vein to the liver, thence, by the hepatic veins and vena cava to the right side of the heart, from which they reach the lungs by the pulmonary arteries. It was found that many newly hatched larvae also pass from the intestine to the mesenteric lymph nodes, especially in the ileocolic nodes, so that it appears probable that migration to the heart may occur also by way of the lymphatic vessels without involving the portal circulation, although larvae have not actually been recovered along this pathway beyond the mesenteric nodes. It was found that the larvae are commonly present in recently infested animals in the peripheral lymph nodes, where their presence can only be explained on the assumption that they have been carried there in the systemic circulation.

Thus the authors were unable to confirm Yoshida's conclusion (*E. S. R.*, 42, p. 75) that the migration of the larvae is effected chiefly by their active burrowing through the tissues of the body. They conclude that apart from burrowing for microscopic distances in the intestinal wall, liver, and mesenteric nodes, the principal if not practically the only means by which *Ascaris* larvae reach the lungs from the intestine is by transport in the circulating blood and lymph.

An earlier account of the present status of knowledge of this insect, by Ransom and the late W. D. Foster, has been noted (*E. S. R.*, 43, p. 275).

Preliminary note on the development of the Leishman-Donovan parasite in spleen juice and in the alimentary tract of *Cimex lectularius* L., H. A. ADIE (*Indian Jour. Med. Research*, 9 (1921), No. 2, pp. 255-260, pls. 4).—The development of this human parasite in the stomach of *Cimex* is described.

The occurrence of virulent and nonvirulent strains of the hemorrhagic septicemia organism in the same animal, H. P. HOSKINS (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 4, pp. 453-460).—In the case of a calf which died of hemorrhagic septicemia, the author found that it had in its system, simultaneously, at death both the virulent and nonvirulent hemorrhagic septicemia organism. The author reports that he has been able to change at will the character of the growth in bouillon of a virulent culture of *Bacterium bovis-septicum* by simply altering the composition of the medium, and he suggests that future experiments may show that its virulence can be altered in the same way. He has reasons to believe that alterations in virulence do take place under natural conditions, and points out that present views on the nature of the disease are based on that assumption.

An epizootic among guinea pigs due to a paratyphoid B bacillus, K. M. HOWELL and O. T. SCHULTZ (*Jour. Infect. Diseases*, 30 (1922), No. 5, pp. 516-535).—An infectious disease that developed among guinea pigs in the summer of 1920, characterized by multiple tubercle-like lesions of the spleen and liver, was of that type to which the name pseudotuberculosis has been applied.

"The infection quickly assumed epizootic proportions and led to the death of more than 500 animals before it was brought under control. At the height of the epizootic many of the guinea pigs died without typical lesions but with positive blood cultures. Females were much more highly susceptible to spontaneous infection than males, and pregnant females were especially susceptible. In the pregnant animals purulent metritis was not infrequent."

A Gram-negative, motile bacillus, which had the cultural characteristics of the colon-typhoid intermediate group was isolated from the lesions of the heart blood, usually in pure culture. "Immunologically the organism was distinct from the representatives of the four fixed species of the group, namely, *Bacillus paratyphosus* A, *B. paratyphosus* B, *B. enteritidis*, and *B. suispestifer*, which were used for comparative study; it was agglutinated in low dilutions (1:160) of a serum against the Jordan strain of human paratyphoid B. It was closely related to, although not absolutely identical with, two guinea-pig and one rabbit strain received from another source. It was virulent, on artificial inoculation, for guinea pigs, rabbits, white mice, and white rats. The epizootic was apparently brought under control by immunization of the guinea pig stock with a killed polyvalent suspension of the organism."

Rinderpest immunization, J. WALKER (*Kenya Colony Dept. Agr. Bul.* 2 (1921), pp. 9-135).—This is the report of an extensive investigation of the causes of mortality in cattle undergoing rinderpest immunization and of possible means of improving the methods of immunization. The first part of the investigation was conducted in three districts in East Africa in which there had been a mortality of 3.9 to 34 per cent, chiefly in young stock, following rinderpest double inoculation. In some cases the cause of death was found to be rinderpest, in others pneumonia following rinderpest, and in a number of cases piroplasmiasis or anaplasmosis. Sometimes anemia was either a contributory or the originating cause of death. Among cattle in a fair or poor condition there was a higher mortality than in those in good condition. A long period of drought, with absence of good grazing, is thought to have contributed to the lessened resistance.

The experimental studies of immunization methods included determinations of the best amount of serum to be used, a study of the cause of nonreaction to rinderpest in some inoculated cattle, a study of methods of immunizing unweaned calves of both immune and susceptible mothers, and a study of the

serum-alone treatment of susceptible cattle. As a result of these studies detailed directions for the use of antirinderpest serum are given essentially as follows:

The serum-alone method, which is sometimes used when rinderpest occurs in the vicinity of a susceptible herd or when the disease has actually appeared in the herd, consists in the subcutaneous injection of the serum behind the shoulder at intervals of a fortnight until at least 14 days have elapsed since the occurrence of symptoms in any animal of the herd or until all danger of infection has disappeared. For cattle of average susceptibility the recommended dose is 15 cc. per 100 kg. body weight, but for highly susceptible animals the dose may be increased to 20 cc. It has been found that animals which contract rinderpest by contact when under serum treatment usually recover and acquire immunity, and that large doses of the serum may have a curative effect if injected in the early phases of the disease.

The serum-virulent blood method consists in the subcutaneous injection either in the neck or behind the shoulder of 20 cc. of serum per 100 kg. body weight (with larger amounts for highly susceptible cattle) and 2 cc. of virulent blood in the other side of the body. The blood should be collected at the height of the temperature reaction and used without delay. With this method the temperature of the inoculated animal rises after an incubation period of from 5 to 6 days, and pronounced symptoms of rinderpest develop during the next 5 or 6 days. The animal usually recovers by the fourteenth day after the inoculation and is then immune.

It has been shown that unweaned calves born of immune parents may possess a partial but incomplete immunity. In such animals the inoculation of virulent blood alone may produce no apparent or only a slight reaction, while in others there may be a visible and sometimes a fatal reaction. In unweaned calves born of susceptible mothers there is generally a high percentage of mortality following the inoculation of fresh virulent blood. The double reaction of unweaned calves may or may not produce immunity.

Various precautions and warnings in regard to inoculation are given.

The trypanosomiasis of Ruanda, R. VAN SACCEGHEM (*Bul. Agr. Congo Belge*, 12 (1921), No. 2, pp. 294-302).—The trypanosome occurring in Ruanda, which has been provisionally named *Trypanosoma ruandae*, is a species pathogenic for bovines, ovines, caprines, and probably equines. It is polymorphous, without free flagella, and, morphologically, resembles *T. dimorphon*, *T. congolense*, and *T. pectorum*, especially the latter two. Intramuscular injections of tartar emetic caused its disappearance from the peripheral circulation during a period of seven or eight days. The methods of treatment thus far tested have not given satisfactory results. The presence of a hyperleucocytosis (polymorphonuclear neutrophils) is prognostic of recovery, and on the contrary a lymphocytosis is unfavorable.

What we know about avian tuberculosis, F. B. HADLEY (*North Amer. Vet.*, 3 (1922), No. 4, pp. 217-219, 221).—This is a general discussion of the symptoms, mode of infection, and methods of diagnosis of avian tuberculosis, with suggestions for the management of infected flocks and for the control, eradication, and prevention of the disease.

Prevention and control of tuberculosis, A. T. KINSLEY (*Vet. Med.*, 17 (1922), No. 4, pp. 162-164).—Brief suggestions are given for the control of tuberculosis in cattle, swine, and poultry.

The preservation of milk with potassium dichromate without destruction of tubercle bacilli, KRAUTSTRUNK and FORST (*Ztschr. Fleisch u. Milchwiss.*, 32 (1922), No. 10, pp. 121-124).—The authors have found that potassium

dichromate added to milk in the proportion of 1:500 parts does not destroy tubercle bacilli. They therefore recommend this method of preserving milk samples to be used in testing for tubercle bacilli.

Further study of the etiology of an undiagnosed disease of cattle, W. A. HAGAN (*Cornell Vet.*, 12 (1922), No. 1, pp. 43-54).—A fatal undiagnosed disease of cattle which was previously described as occurring during the late summer and fall months of 1919 in certain parts of New York State (E. S. R., 46, p. 82) recurred at practically the same time in 1920 in most of the localities previously affected, as well as in a number of new places. The characters of the disease were about the same as in 1919, although one outbreak did not show the characteristic liver lesions previously described. The only lesions which have been constant in all cases seen up to the present time are the ulcers in the fourth stomach and ileum. Inoculation experiments on cattle and small animals have been uniformly negative. The disease has not been transmitted, and thus it has not been proved to be infectious. Poisonous plants have been sought as the causative agent without success. Prophylactic and curative treatment has not proved successful.

The occurrence of agglutinins and amboceptors in the milk of aborting cows, W. POMPER (*Wiener Tierarztl. Monatschr.*, 7 (1920), Nos. 9, pp. 265-279; 10, pp. 297-308).—This paper reports a comparison of the use of blood and milk serum for the complement fixation and agglutination tests for detecting the presence of *Bacillus abortus*. In making the test sweet milk is considered preferable to sour, and it also has been found advisable to preserve the original milk with 0.5 per cent phenol instead of waiting until the serum has been separated before adding the preservative.

Of 76 animals considered by the blood test to be noninfected, the milk serum in amounts of 0.1 cc. in no case gave complete agglutination, and with one exception did not give complete complement fixation with 0.5 cc. Using these amounts as limiting values, of 39 cases of animals whose blood serum reacted positively, the agglutination test was positive in 97.4 per cent and the complement fixation test in 100 per cent when the milk serum was used in place of blood serum. Out of 3 cases in which the outcome of the blood tests was doubtful in that the agglutination and complement fixation tests contradicted each other, the milk test agreed with the blood test in 2 cases. In cases in which the blood serum gave positive agglutination but negative complement fixation tests, similar results were obtained with milk serum. In 8 animals the blood serum gave a positive complement fixation test near the limiting value, while the agglutination test with the blood serum and both tests with milk serum were negative. Animals vaccinated six months previously with abortin showed no antibodies in the blood serum in 46.5 per cent, and a doubtful reaction in 15.1 per cent.

The antibody content of the milk serum is considered to be generally lower than that of the blood. In one case the agglutination titer of the milk corresponded with that of the blood, while in another case it exceeded that of the blood. These cases of high antibody content of milk serum are attributed to the formation of local antibodies.

A list of 18 references to the literature is appended.

An unidentified hemorrhagic disease in cattle (*Nevada Sta. Rpt. 1920*, pp. 14, 15).—This is a brief statement of work by E. Records with this affection, of which a more recent account under the name ictero-hemoglobinuria has been noted (E. S. R., 46, p. 684).

Hog disease investigations (*Indiana Sta. Rpt. 1921*, p. 43).—Attention is called to hog cholera transmission investigations. It was found that in a

closed house a complete cheesecloth screen placed in the middle of a 3-ft. space between a double wire partition protected control animals on one side of the screen against infected animals on the other side. An incomplete cheesecloth partition which left spaces for dust to pass through did not protect the controls.

Hog cholera infection, W. W. DIMOCK and D. J. HEALY (*North Amer. Vet.*, 3 (1922), No. 5, pp. 267-269).—The erratic and persistent nature of hog cholera virus is emphasized by the report of observations made on eight herds of brood sows and shoters. In some instances the virus has disappeared following an outbreak of hog cholera to such an extent that nonimmune pigs have been kept on the farm without contracting the disease. In other cases where the animals have been immunized the virus has remained to such an extent that it is impossible to raise pigs without treating them during the first few days or weeks of life.

Influenza of swine, "hog flu," broncho-pneumonia, W. W. DIMOCK and D. J. HEALY (*North Amer. Vet.*, 3 (1922), No. 3, pp. 133-141).—This discussion includes reports of cases occurring in a number of herds in Kentucky. The general opinion, according to reports, is that many outbreaks of the so-called "hog flu" are forms of hemorrhagic septicemia, or swine plague. It is pointed out that the affection is now recognized to be a distinct disease. The specific cause, however, has not as yet been definitely determined, bacteriological studies of the blood from acute cases having invariably given negative results.

Suggestions on porcine abortion (*Vet. Med.*, 17 (1922), No. 4, pp. 172-174).—A general discussion of the etiology and control of abortion in swine.

Distomiasis of swine, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 49 (1921), Spanish ed., pp. 5-8, fig. 1).—A brief account of this parasitic affection in Porto Rico, where the fluke (*Distoma hepaticum*) is known as "la cucaracha."

Grass disease and botulism, J. B. BUXTON (*Vet. Jour.*, 78 (1922), No. 562, pp. 125-128).—This paper relates to a well-known disease of equines in certain parts of northern England and Scotland which was first investigated by a special committee in 1918. The symptoms of this affection appear to be identical with those of so-called forage poisoning of horses and cattle in the United States, and an organism indistinguishable from *Bacillus botulinus* was recovered by Tocher at Aberdeen early in 1919 from diseased portions of intestine and from the spleen of several cases of grass disease. The author's investigations which followed resulted in finding that the blood of several horses which had recovered from the affection contained traces of botulinus antitoxin, type A, and that its presence was undetectable in the blood of more than 40 normal horses which were similarly tested. It was found that such blood contained complement binding antibodies for *B. botulinus*, and that these antibodies did not show the same specificity for the homologous type as did the antitoxin.

Chicken pox (avian diphtheria) and roup, H. J. STAFSETH (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 99-104).—This is a brief summarized account of these diseases and means for combating them.

Exterminating poultry lice, W. T. JOHNSON (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1922), No. 7, pp. 114-117, figs. 9).—This summary of information deals with the subject under the headings of principles underlying treatment, the dip method, the dust method, effectiveness of the sodium fluorid treatment, etc.

RURAL ENGINEERING.

Actuarial factors in the design of irrigation structures, H. B. MUCKLESTON (*Engin. Jour. [Canada]*, 5 (1922), No. 4, pp. 192-197).—This is a compilation of some of the well-known principles which it is stated are often overlooked in the design of irrigation structures. Special attention is drawn to economic factors in relation to storage works, the value of storage, available storage, capacity in relation to dam height and cost, and storage capacity.

Report on hydraulic problems of the Colorado River, C. A. RISSELL (*Reclam. Rec. [U. S.]*, 13 (1922), No. 3, pp. 41-45).—The important factors involved in the control of floods and the development of the irrigation resources of the Colorado River are summarized briefly.

The Colorado River and Arizona's interest in its development, G. E. P. SMITH (*Arizona Sta. Bul.* 95 (1922), pp. 527-546, figs. 2).—This is an address delivered at the Annual Farm and Home Week at Tucson, Ariz., January 18, 1922, in which the problems relating to the development of the Colorado River in Arizona, chiefly from the standpoint of irrigation, are briefly presented and discussed.

Report on drainage and prevention of overflow in the valley of the Red River of the North, P. T. SIMONS and F. V. KING (*U. S. Dept. Agr. Bul.* 1017 (1922), pp. 89, pls. 28, figs. 17).—This report presents the results of a preliminary examination providing for drainage and the prevention of overflow of the low-level lands in the valley of the Red River of the North. The watershed in question has an area of nearly 36,000 square miles, of which 8,500 square miles lie within the valley. Drainage in this valley is an interstate matter between the States of Minnesota, North Dakota, and South Dakota. The report contains a summary of recommendations resulting from the preliminary examination, together with a large amount of topographic and hydrographic data.

Drainage layouts, V. OVERMOLT (*Ohio Agr. Col. Ext. Bul.*, 17 (1921-22), No. 6, pp. 8, figs. 7).—Popular information on the planning of tile drainage layouts, with particular reference to conditions in Ohio, is presented.

Vertical drainage, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 3, pp. 97, 98, fig. 1).—Brief information is given on the installation of vertical drainage heads.

Keeping the water supply pure, E. W. LEHMANN (*Agr. Engin.*, 3 (1922), No. 3, pp. 39-41, figs. 4).—This is a part of the report of the subcommittee on farm sanitation, presented at the fifteenth annual meeting of the American Society of Agricultural Engineers, and consists of a summary of information from different State and Federal institutions bearing on the subject. Emphasis is laid on the prevalence of farm water supplies of poor quality, and general recommendations for securing safe and pure water supplies are presented.

New engineering developments in land clearing, J. SWENEHART (*Agr. Engin.*, 3 (1922), No. 4, pp. 63-66, fig. 1).—The more recent developments of the engineering features of land clearing are outlined in this report, together with the results of experimental work.

In studies of the draft required in stump pulling, it was found that white pine stump in soils varying from sand to red clay required a pull varying with the size of the stump, its age, the kind of soil, and many other conditions. It was found absolutely essential to use sufficient dynamite in the beginning to split the stump, to facilitate handling of the pieces after pulling. The pull on stumps 2 ft. in diameter and over ranged from a little over 10,000 lbs.

to between 24,000 and 25,000 lbs. Pulls of 25,000 lbs. broke ordinary $\frac{3}{4}$ -in. cable, while pulls up to 18,000 lbs. were safely made. The trials indicated that from 30 to 40 per cent of the breaking strength of the cable is a fair load in stump puller work where the speed is slow. In the design of machinery a maximum pull of from 15,000 to 18,000 lbs. seems desirable under Wisconsin and Lake States conditions.

In skidding and piling tests, it was found that a maximum pull of approximately 2,500 lbs. is desirable. Speed and flexibility in skidding and piling are considered to be the essentials of all-around land clearing equipment. Piling is considered to be the most important part of the land clearing job.

Cut-over land management, D. L. McMILLAN and G. W. PUTNAM (*Michigan Sta. Spec. Bul. 110 (1921), pp. 37, 38*).—Brief popular information on the clearing and management of cut-over lands in northern Michigan is presented.

Report upon the construction and maintenance of military and post roads, bridges, trails, and of other roads, tramways, bridges, ferries, trails, and related work in the Territory of Alaska ([*War Dept. U. S.*], *Alaska Road Comm. Ann. Rpt. 1921, pp. 54, pls. 11, fig. 1*).—This report describes the activities of the Board of Road Commissioners for Alaska with reference to the construction and maintenance of roads, bridges, trails, and related works for 1921.

The use of calcium chlorid in concrete highway construction, B. H. PIEPMEIER and H. F. CLEMMER (*Engin. and Contract, 57 (1922), No. 14, pp. 323, 324, figs. 2*).—Laboratory and field investigations by the Illinois Division of Highways on the use of calcium chlorid in concrete road construction are reported. It was found that calcium chlorid accelerates the setting of concrete in cold weather, and may be used as a simple and practical means of curing.

In laboratory studies of over 450 specimens, the greatest transverse strength was developed in those specimens treated with calcium chlorid, and the best results were given by specimens the bare surfaces of which were sprinkled with the granulated chemical at the rate of 3 lbs. per square yard of surface. This method of curing resulted in stronger specimens at the end of 14 days than did the wetted earth method at the end of 28 days. The beneficial effect of calcium chlorid in such use occurred chiefly within the first 24 hours after its application.

Investigations bearing upon the effect of placing concrete at low temperatures indicated that under such conditions calcium chlorid incorporated in the mixture at the rate of from 2 to 3 per cent of the weight of the cement produced the best results in hastening the setting process, in securing an earlier strength, and in preventing injury to the road by the action of frost or freezing.

The effect of alkali on Portland cement, K. STEIK (*Wyoming Sta. Circ. 16 (1922), pp. 4, figs. 2*).—This circular summarizes the results of several years' study of the subject at the station. It has been found that the decrease of strength of cement in solutions of the salts which make up alkali is comparatively slow. The rate of disintegration depends to a certain extent upon the salts present in solution, their concentration, and upon the proportion of cement in the concrete. Mortars containing lesser quantities of cement disintegrate in correspondingly shorter periods of time. The bad effect of alkali does not become evident for some time after the concrete has been placed in solutions thereof.

Of the various salts which might be present in the alkali, magnesium chlorid has the greatest disintegrating effect upon concrete, followed in order by sodium sulphate and magnesium sulphate. The presence of sodium chlorid increases

the harmful effect of the sulphates, while sodium chlorid alone has a very slight effect if any. Sodium carbonate retards the action of sulphates. Solutions of calcium sulphate showed no bad effects during the extent of the experiments.

In general the decrease of the tensile strength of concrete is more rapid than that of the compressive strength under the action of alkali. The age of cement or concrete before it comes into contact with solutions of alkali does not seem to have a great effect upon the rate of disintegration.

The effect of alkali upon the appearance of concrete depends to a certain extent upon its cement content. In actual practice it has been observed that the concrete in contact with alkali disintegrates much faster than could be expected on the basis of laboratory experiments. After concrete has been placed the action of alkali is augmented by changes in temperature, freezing, and thawing, vegetation, and insects.

Cement in 1919, E. F. BURCHARD (*U. S. Geol. Survey, Min. Resources U. S.*, 1919, pt. 2, pp. 387-404).—Data are given in this publication on the production, consumption, manufacture, supply, exports, and imports of Portland cements during 1919. Sections are also included on natural and puzzolan cements. It is stated that the total quantity of Portland, natural, and puzzolan cements marketed or shipped from the mills in the United States in 1919 increased 20.7 per cent in quantity and 29.5 per cent in value over 1918.

Comparative strength--ironbark and jarrah, R. D. FLAY (*N. S. Wales Forestry Comm. Rpt.* 1920, p. 24).—The results of a comparative test of selected beams of ironbark and jarrah which were cut free of center heartwood are reported. The tests were made on a 10-ft. span and the load was applied at points equidistant from the center, the position of the rings being in a horizontal plane. The jarrah failed by tension and shear, while the ironbark failed by clean shear. The ultimate breaking load of the former was 33.69 tons and of the latter 37 tons.

Handbook of construction equipment, R. T. DANA (*New York and London: McGraw-Hill Book Co., Inc.*, 1921, pp. XV+849, figs. 351).—This handbook brings together a large amount of information regarding construction equipment, its cost, and use.

Material handling cyclopedia, compiled and edited by R. V. WRIGHT ET AL. (*New York: Simmons-Boardman Pub. Co.*, 1921, pp. [2]+847, figs. 1166).—This volume is designed to present definitions, descriptions, illustrations, applications, and methods of operation of the devices and equipment used in industry for the handling of materials. It is divided into three principal sections. In the definition section are defined the devices, accessories, and terms used in material handling. The illustrated text section is subdivided into divisions on hoisting machinery, package handling, conveyors and elevators, loose material conveyors and elevators, conveying machinery details, elevators, trackless transportation, industrial rail transportation, and handling systems. The catalogue section contains detailed information on specific devices.

Motor alcohol: Its theory and use, J. P. FOSTER (*Sugar Cent. and Planters News*, 2 (1921), No. 11, pp. 521-526, figs. 3).—The results of considerable experience on the development of alcohol as a motor fuel are presented and discussed. It has been found that alcohol treated with ether which has been obtained from alcohol by dehydration makes the best motor fuel. The action of corrosive compounds formed by the combustion of such a mixture is considered to be a serious problem. The author's investigation of the subject has shown that the most suitable basic chemicals for neutralizing the corrosive acids in the mixture are the amines, either primary, secondary, or tertiary.

Report on agricultural implements and machinery, W. HARRISON ET AL. (*London: [Gt. Brit.] Standing Com. Invest. Prices, 1921, pp. 10*).—This is a report of a special subcommittee on the investigation of prices and costs of certain types of agricultural implements and machinery and profits obtained therefrom.

No evidence of profiteering in the agricultural implement industry was found. The evidence indicates that the agricultural implement industry in Great Britain has been passing through a difficult and critical period which has resulted in a general decrease in business. This is attributed to a decrease in export trade due to war conditions, the rise in cost of raw materials, labor troubles and costs, and the resulting high cost of the finished product. The opinion is expressed that the industry will not resume its normal condition until the markets in central and eastern Europe are effectively reopened. It is concluded that general standardization is impracticable at present, but that it is greatly desirable that superfluous types be eliminated.

The manufacture and sale of farm equipment in 1920, H. R. TOLLEY and L. M. CHURCH (*U. S. Dept. Agr., Dept. Circ. 212 (1922), pp. 11*).—This circular contains figures relating to the number and value of gas tractors, steam traction engines, plows and listers, tillage implements, planting, cultivating, haying, and harvesting machines, horse-drawn vehicles, machines for preparing crops for market or use, and selected items of farm equipment manufactured and sold during 1920. A summary of the data obtained from 583 firms who handled such farm equipment during the year is presented. The total value of the equipment manufactured by these firms is placed at \$536,945,000 and the value of domestic sales at \$471,442,000.

Report on disk harrow investigation, E. V. COLLINS, C. I. GUNNESS, A. E. BRANDT, and E. J. STIRNIMAN (*Agr. Engin., 3 (1922), No. 3, pp. 44, 45*).—The results of an investigation to determine whether the cutaway disk has sufficient real merit to justify the continuance of its manufacture are presented. Information was obtained by the use of a questionnaire and by field tests of a comparative nature, which were conducted at the Iowa and California Experiment Stations.

The general conclusion is drawn that the disadvantages of the cutaway disk far outweigh its advantages. In the draft tests it was found that the full bladed disk always gave a lighter draft than the cutaway disk, averaging about 15 per cent. The cutaway blades penetrated more deeply than the full blade, but the deep penetration was intermittent and on hard ground the cutaway blades were often broken.

Modern developments in farm tractors, H. E. GARNER (*Jour. Rath and West and South. Counties Soc., 5. ser., 15 (1920-21), pp. 62-73, pls. 2*).—The developments during the past few years in farm tractors are briefly summarized, particularly from the British viewpoint. The conclusion is drawn that developments in method and procedure with farming are as essential as changes in construction and design of power units and implements, and that the tractor must be regarded not as a supplement to horsepower but as a new form of power.

The Shrawardine tractor trials, 1921, T. CLOSE, B. J. OWEN, and H. G. RICHARDSON (*Jour. Min. Agr. [London], 28 (1922), No. 11, pp. 973-981*).—A critical review is given of the results of the tractor trials conducted at Shrawardine, England, during September, 1921, and opinions expressed as to desirable lines of further development of tractors and tractor-drawn implements.

The conclusion is drawn that the conditions under which trials are conducted do not give sufficient time or opportunity for adequate testing. This

is thought to be more apparent with implements than with tractors. The authors are convinced of the value of trials, including the sustained tests which will extend to laboratory work on materials and soil samples and which will embrace durability and be continued as far as the resultant crop.

Tractors in New Hampshire, F. W. TAYLOR (*N. H. Agr. Col. Ext. Circ. 47* (1922), pp. 4, fig. 1).—A brief report of a survey of the tractor situation in New Hampshire is presented which includes information obtained from 58 tractor owners.

It was found that the tendency in the State is toward the use of larger tractors. There are only a limited number of farms in the State with sufficient tillable land to justify the purchase of a tractor unless extended use is made of it for belt power. Eighty-one per cent of the tractor owners expressed themselves as being satisfied with their tractors. Most of those who are dissatisfied either had a tractor which was too small or one of a type not suited to their particular needs.

Recent developments in farm buildings, F. C. FENTON (*Agr. Engin., 3* (1922), No. 4, pp. 59-62, figs. 4).—Some of the important features of the recent developments in farm buildings are described in this report.

In a discussion by A. W. Clyde, an analysis of the stresses of the Gothic barn roof is presented, with a view to showing the strength and durability of this type of roof. The conclusion is drawn that practically nothing of a definite nature is known of the strength of ordinary barn roofs.

The analysis indicates that none of the common types will withstand a wind of 90 miles per hour or a pressure of 30 lbs. per square foot. However, it is not considered necessary or desirable to provide for any such wind load, and it is pointed out furthermore that the ordinary barn frame would not withstand such winds even if the roof could. The Gothic roof with bent rafters and also the braced rafter need to be strengthened considerably to safely withstand a wind of from 50 to 65 miles per hour or a pressure of from 10 to 15 lbs. per square foot.

It is further concluded that the Shawver frame is not a real truss and should not be analyzed as such. The urgent need for studies to determine the strength of the Shawver and the braced rafter styles, and also to determine how well the Gothic bent rafter will act as a unit, is emphasized.

Sound-proof partitions, F. R. WATSON (*Ill. Univ., Engin. Expt. Sta. Bul. 127* (1922), pp. 85, figs. 31).—This is a summary of available information on the acoustic properties of various building materials, together with practical applications of the fundamental principles involved. It is shown that sound may be transmitted from one side of a partition to the other by progressing through continuous air passages, by passing as an elastic wave through the solid structure, or by causing the partition to vibrate and originate sound waves on the farther side. It is concluded that in order to obtain a sound-proof partition it should be as rigid and free from air passages as possible, and partitions, floors, and ceilings between adjacent rooms should be made continuous and rigid.

Hog houses for Nebraska, O. W. SLOGREN and I. D. WOOD (*Nebraska Sta. Circ. 14* (1922), pp. 20, figs. 20).—The material contained in this circular is a culmination of several years' study and investigation of the different types of hog houses used in Nebraska. Diagrammatic illustrations are given to bring out the essential factors established by the investigation and to serve as a guide in planning houses suited to particular conditions.

Poultry housing, O. M. WILBUR (*Maine Agr. Col. Ext. Bul. 133* (1922), pp. 12, figs. 10).—Popular information is given on the construction of colony and laying houses, with particular reference to conditions in the State of Maine.

RURAL ECONOMICS AND SOCIOLOGY.

The rural community, L. MACGARR (*New York: Macmillan Co., 1922, pp. XV+239, pl. 1, figs. 16*).—Economic and social phases of rural life are discussed in nine chapters, to each of which are added questions for further study and a list of readings. The survey is discussed as a means of making an inventory of the assets and liabilities of the community, furnishing a basis for a program of improvement of community life. Socially defective individuals found in rural communities are classified and described, and recommendations are made for the giving of mental tests in the rural schools. The functions of the district and secondary schools are outlined, and suggestions are offered for the improvement of these important factors. Certain specific economic and social forces are discussed.

The land and the people, H. MATTHEWS (*Jour. Bath and West and South. Counties Soc., 5. ser., 15 (1920-21), pp. 1-16*).—Certain proposals with regard to land nationalization in England are summarized and met with negative arguments.

Land values in lower Lombardia in relation to new provisional taxation, E. MARENGHI (*Ann. Ist. Agr. [Milan], 15 (1919-20), pp. 41-67*).—Detailed study is made of market values of agricultural land, its valuation on the basis of crop returns, and its assessable value.

A study of a banking system for agriculture and viticulture, L. SEMICHON (*Rev. Vitic., 55 (1921), Nos. 1424, pp. 265-268; 1425, pp. 281-285, fig. 1; 1426, pp. 307-312, fig. 1; 1430, pp. 386-391; also in Prog. Agr. et Vitic. (Ed. l'Est-Centre), 42 (1921), Nos. 38, pp. 281-284; 39, pp. 307-310; 40, pp. 328-332, fig. 1; 41, pp. 354-358; 42, pp. 379-381*).—Data presented in this article indicate that returns to vineyardists are distributed fairly well through the year and that the difference between costs of production and the possible resources of the grower amounts to a considerable sum between September and April. The amount available for deposits in an agricultural bank is sufficient to justify advances to the grower and to the distributor. The professional organization of the wine-growing industry for financing its own operations is urged.

The costs of crop production in Missouri, 1921, E. H. FRANK (*Missouri Sta. Bul. 190 (1921), pp. 15, figs. 2*).—The data used in this bulletin were secured partly from detailed farm records kept over a period of 11 years by the department of rural life at the Missouri Station in cooperation with farmers in every section of the State and partly from answers to questionnaires.

The average cost of wheat delivered at the local market in 1921 was \$2.34 on the basis of 10.9 bu. an acre; that of oats, with an average yield of 20 bu. per acre, 69 cts.; and of hay, on the basis of an average yield of 1.15 tons an acre, \$12.60 a ton. The corn crop, at an average yield per acre of 30.75 bu., cost 62 cts. per bushel at the farm. It is asserted that not a single county in the State sells its wheat, oats, or corn crop at the present market prices for enough to cover the cost of production. In some counties the hay crop has returned a profit, while in others it was not worth the cost of harvesting. It appears that production costs reached the peak in 1920, and in November, 1921, were on the decline.

Harvest labor problems in the wheat belt, D. D. LESCOHIER (*U. S. Dept. Agr. Bul. 1020 (1922), pp. 35, figs. 7*).—Information as to dates of wheat harvest, demands for and the character of harvest labor, its mobilization and distribution, and harvest wages in the season 1920 was collected by field agents of the Office of Farm Management and Farm Economics by means of interviews with nearly 3,000 harvest hands, farmers, and others in the harvest area of Oklahoma, Kansas, Nebraska, Iowa, and the Dakotas.

It was found that many transient laborers secure work of less than a week's duration. On an average, men spent 26 days in the harvest area, working 15 days and losing 11.

Maps are given showing dates when harvest begins and when it is general for both winter and spring wheat areas in the United States.

The harvest labor force is said to consist of four groups: (1) Residents of towns of the small-grain States who hire out to farmers in near-by territory, (2) men who make contracts with farmers from year to year, (3) transient laborers who leave their regular employment to work temporarily in the harvest fields, and (4) transients for whom the harvest is regularly or frequently a part of the year's work.

Interviews with 153 harvest hands revealed the facts that the majority started life in humble homes, a few were foreign born, and fewer than the majority had accumulated savings or were property owners.

The outstanding labor problem of the wheat harvest is said to be the mobilization and distribution of an adequate but not excessive labor force. The authoritative prediction of needs and accurate information about the harvest are greatly to be desired. It is also deemed desirable that a definite standard wage be established annually for each State or each region, such standards to be as nearly uniform as possible under the prevailing conditions; that employment offices be maintained; and that they follow the policy of adhering to the "going wage."

Preliminary report on harvest labor investigations, 1921. D. D. LES-COMIER (*U. S. Dept. Agr. Off. Farm Management and Farm Econ., 1921, pp. 9*).—The results of this harvest labor survey corroborate in general those noted above.

Of 1,164 harvest hands interviewed in 1921, only 14 per cent were residents of the States where they were working. Of 14,133 others, in regard to whom data were obtained through the U. S. Employment Service, 4,130 were regularly engaged in farm work, 4,654 were common laborers, and the remainder were in the trades and miscellaneous lines. Of 1,124 men who gave facts about their harvest experience, 175 were in the harvest for the first time, 431 had made from 1 to 5, and 528 from 6 to 30 harvests.

Figures given on earnings and expenses by 1,022 of the men interviewed showed average earnings of \$40.09, their average expenses for subsistence while idle being \$15.88, making the net return on the season's work less than \$25. Eighty-one men were found who reported gross earnings of more than \$100 for the season, the average for the group being \$148.32. Thirty-two were found whose accounts showed deficits averaging \$32.26.

Comparatively few men were found who migrated from the winter-wheat region to the spring-wheat region.

Rural child labor, a symposium (*Amer. Child, 3 (1921), No. 1, pp. 33-45*).—In these pages are published contributions to the general subject from B. H. Crocheron, E. Mead, D. Sanderson, and J. R. Howard. A brief bibliography is included.

National Conference on Child Labor (*Amer. Child, 3 (1921), No. 2, pp. 161-183*).—Papers and abstracts of papers that were presented at the sixteenth conference on child labor, held in Milwaukee in June, 1921, are published here as follows: Feeding the Spirit of Childhood, by E. C. Lindeman; What is Rural Child Labor? by C. E. Gibbons; and Neglected Children of Appalachia, by S. A. Brown.

Self-service in the retailing of food products. F. E. CHAFFEE and MCF. KERBEY (*U. S. Dept. Agr. Bul. 1044 (1922), pp. 52, figs. 14*).—This is a report on a study of the principles of self-service and their application to retail dis-

tribution of foodstuffs carried on by representatives of the Bureau of Markets in a number of city stores of the self-service type. The advantages and disadvantages of the system, and problems of location, store arrangement, fixtures, selection, grading, and display of merchandise, prevention of thievery, and the development of large volume and rapid turnover in the business are discussed, as well as the handling of perishable farm products and methods of accounting.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 1 (1922), Nos. 13, pp. 265-288, figs. 4; 14, pp. 289-304, figs. 5; 15, pp. 305-336, figs. 3; 16, pp. 337-352, figs. 4).—Current weekly reviews of weather conditions, with temperature and precipitation charts, are given, also tabulated reports and special articles on the receipts and prices of important classes of agricultural products and particular commodities in the markets. No. 14 contains an article briefly summarizing the apple season of 1921-22. The April crop report is included in No. 15, giving the usual estimated farm value of important products and averages of prices received by producers. Reports on crop conditions and prices, production of specific crops, and the farm labor supply and demand, April 1, appear also.

[**Agriculture in Mexico**], edited by R. G. CLEVELAND (*Mex. Yearbook*, 1920-21, pp. 239-255).—The important agricultural products of Mexico, the kinds and relative number of live stock raised, and the forestry resources of the country are briefly noted. Certain hindrances to agricultural progress are set forth.

The collection of annual agricultural statistics, RUZETTE (*Min. Agr. [Belgium] Admin. Agr. et Hort., Serr. Assoc. et Statis. Pubs.*, No. 5 (1921), pp. 12).—The text is given of a decree of November 17, 1921, setting forth the time and methods for the collection of statistics of production, live stock, numbers of animals killed, and prices of agricultural products in Belgium. Blank forms on which this information is entered are included.

AGRICULTURAL EDUCATION.

The county home bureau in Illinois, J. L. BANE (*Illinois Sta. Circ.* 253 (1922), pp. 8).—The aim of the home bureau, how it is financed, its organization and activities, and the function and qualifications of the home adviser are briefly explained.

The schools of agronomy of Lima (Peru) from 1910 to 1915, C. DENEUMOSTER (*Ann. Gemblour*, 28 (1922), No. 3, pp. 69-84).—A résumé is given of five years' growth and development of certain institutions established in Peru about 1902.

A university education for cultivators and rural proprietors, E. LEPPLAE (*Rev. Gén. Agron.*, n. ser., 11 (1921), No. 5, pp. 141-146).—This describes certain changes in the organization of higher agricultural education in Belgium which were previously noted (*E. S. R.*, 45, p. 597).

[**Report of a tour of inspection of practical agricultural schools in the Midi**] (*Bol. Min. Agr. [Portugal]*, 2 (1919), No. 2-6, pp. 247-251).—A brief account is given of the aim of the schools of agriculture and horticulture of Antibes and Hyères in France and of the courses of study offered.

An educational experiment, H. S. KELOWIN (*So. African Jour. Sci.*, 18 (1921), No. 1-2, pp. 172-182).—This paper outlines a scheme for the education of Rhodesian natives, particularly the Matabeles. The plan is to develop simple industries and home crafts by giving instructions in building, agriculture, stock raising, rope and mat making, basketry and chair making, pottery, carpentry, smithing and wagon repairing, and first-aid training. Two

schools have been started under Government supervision in southern Rhodesia, one about 20 miles from Salisbury for the Mashona people and the other about 70 miles from Bulawayo for Matabele people. The outlay and teaching facilities at these schools are briefly described.

The new experiment stations in Italy, V. STRINGHER (*Atti. R. Accad. Georg. [Florence]*, 5. ser., 18 (1921), No. 2, pp. 64-82).--The agricultural experiment station at Bari, the experimental institute of agricultural mechanics at Milan, the national institute for cereal plant breeding, the institute for the improvement of cereals at Bologna, the experiment station at Bergamo for corn cultivation, the rice culture station of Verucelli, the dairy institute at Lodi, the experiment station for cold storage investigations at Milan, the bacteriological station at Crema, the poultry station at Rovigo, and other agricultural services are briefly described. The station at Bari was organized by legislation of 1919 in the place of an old school of olive cultivation and oil production created in 1881, practically suspended in 1901, and closed by Government decree in 1918. The one at Lodi was founded by a decree of April 30, 1871, but reorganized in 1919. The other institutions have been established for the most part since 1910.

Civic and economic biology, W. H. Atwood (*Philadelphia: P. Blakiston's Son & Co.*, 1922, pp. XI+470, figs. 364) --The subject matter included in this textbook is divided into seven units, on how plants and animals live, the relation of life to food, the responses of plants and animals problems of growth and reproduction, plant and animal breeding, the doctrine of evolution, and a few problems in civic and economic biology.

Gardening, A. B. STOUT (*Yonkers-on-Hudson, N. Y.: World Book Co.*, 1922, pp. XVI+354, figs. 188) --The early chapters of this text for elementary grades deal chiefly with the important facts and principles of plant growth and reproduction. The later ones take up the practical work of growing garden crops, controlling diseases and pests in the garden, and storing vegetables for home use.

Strawberry club manual, A. S. CORBY (*Illinois Sta. Circ. 254 (1922)*, pp. 12, figs. 4) --This circular is designed to assist the members of a strawberry club in the selection of the site for a strawberry patch, preparation of the soil, choice of varieties and selection of plants, planting, and management and care through the second season.

A mosquito manual for use in New Jersey schools (*New Jersey Sta. Circ. 130 [1922]*), pp. 16, figs. 23).--Teaching material is presented on the life history and methods of control of mosquitoes of the salt marsh, inland marsh, and house groups.

Productive swine husbandry, G. E. DAY (*Philadelphia and London: J. B. Lippincott Co.*, 1922, 3 ed., rev., pp. XIII+363, pl. 1, figs. 95).--This is practically the same as the earlier edition (E. S. R., 33, p. 791).

Principles of farm practice, B. M. DAVIS (*Boston: D. C. Heath & Co.*, 1922, XIII+350, figs. 112).--Principles of plant growth and soil management; production of grain, forage, and miscellaneous crops; care of the farm garden; protection against diseases and pests; and animal production on the farm; also social aspects of the farm home and rural community are defined in this textbook.

Score cards for household exhibits at fairs, compiled by J. D. McCOMB (*Oreg. Agr. Col. Ext. Bul. 338 (1922)*, pp. [12]).--Scores and standards for exhibits of culinary, dairy, and apiary products; needlework and clothing; home-made labor-saving equipment; and other articles are drawn up.

MISCELLANEOUS.

Thirty-fourth Annual Report of Indiana Station, 1921, G. I. CHRISTIE (*Indiana Sta. Rpt. 1921, pp. 56, figs. 31*).—This contains the organization list, a report of the director summarizing the activities of the station, publications of the year, changes in staff, etc., and a financial statement for the Federal funds for the fiscal year ended June 30, 1921, and for the remaining funds for the fiscal year ended September 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Special report of the Upper Peninsula Experiment Station, D. L. McMILLAN and G. W. PUTNAM (*Michigan Sta. Spec. Bul. 110 (1921), pp. 40, figs. 26*).—This summarizes the work conducted and results obtained at this substation for the biennium ended June 30, 1920. The experimental work recorded is for the most part abstracted elsewhere in this issue. Feeding tests with the dairy herd indicated that sunflower silage was more economical than oat-and-pea silage.

Report of Northeast Demonstration Farm and Experiment Station, Duluth, 1920, M. J. THOMPSON (*Minnesota Sta., Duluth Substa. Rpt. 1920, pp. 28, figs. 5*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of West Central Experiment Station, Morris, 1920, P. E. MILLER (*Minnesota Sta., Morris Substa. Rpt. 1920, pp. 36*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Nevada Station, 1920, S. B. DOLEN (*Nevada Sta. Rpt. 1920, pp. 16*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and a report of the director discussing the work and problems of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-first Annual Report of Wyoming Station, 1921, A. D. FAYVILLE ET AL. (*Wyoming Sta. Rpt. 1921, pp. 109-140, fig. 1*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, reports of the director and heads of departments, and meteorological observations. The experimental work reported is for the most part abstracted elsewhere in this issue.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HULL (*Michigan Sta. Quart. Bul., 4 (1922), No. 3, pp. 70-113, figs. 13*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: More Clover Needed in Michigan, by J. F. Cox; Spring Care of the Ewe Flock, by G. A. Brown; Handling Marl, by H. H. Musselman; The Bed Bug, by E. McDaniel; and Inoculation of Legumes, by F. S. Davenport.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 7 (1922), Nos. 1-2, pp. 40, figs. 8; 3-4, pp. 41-72, figs. 9*).—Of these numbers No. 3-4 contains, in addition to several articles abstracted elsewhere in this issue and miscellaneous notes, an article entitled Feeding Young Chicks, by D. C. Kennard, which describes methods used at the station.

Bimonthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1922), No. 7, pp. 101-124, figs. 9*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Artificial Incubation, by Mr. and Mrs. G. R. Shoup; and Overcoming Egg Production Slumps, by Mrs. G. R. Shoup.

Papers presented at a conference on Illinois Agricultural Policy (*Urbana: Univ. Ill., 1922, pp. 195, pl. 1*).—This contains the papers presented at the conference held at the University of Illinois, January 26 and 27, 1922, and noted editorially (*E. S. R., 46, p. 701*).

NOTES.

Delaware College and Station.—The eastern soil fertility conference of the Soil Improvement Committee of the National Fertilizer Association was held at the station June 22 and 23. The station staff had charge of the program during the first day of the conference. Addresses were made by Director C. A. McCue on Work of the Delaware Station along Soil Fertility Lines; G. L. Schuster on Soil Fertility Work with Wheat; Dr. E. M. R. Lankey on Some of the Problems of Plant Nutrition, and L. W. Tarr on The Relation of Soil Acidity to the Availability of Fertilizers. A half day was devoted to inspection of the soil fertility plats on the university farm.

H. R. Baker, assistant bacteriologist at the Kansas Station, has been appointed instructor in biology and research assistant in poultry diseases, vice E. R. Hitchner resigned. The work in poultry diseases is carried on in co-operation with the State Board of Agriculture.

Georgia Station.—J. A. McClintock, plant physiologist, has resigned to become associate plant pathologist at the Tennessee Station. J. G. Woodroof, a recent graduate of the Georgia College, has been appointed assistant horticulturist beginning August 1.

Kentucky University and Station.—A tobacco field meeting was held by the extension division on the station farm August 10. The meeting was designed chiefly to show Burley tobacco growers the difference between the resistant varieties and those commonly grown in the Burley section when the two are planted on soil infected with root rot.

John Gaub, assistant chemist in the public service laboratories, resigned July 1. Recent appointments include J. B. Hutson as assistant professor in farm management in the college of agriculture and assistant in farm management in the station, Berllis Winton as field agent in poultry, and Edward A. Cuslick as assistant in veterinary science in the station.

Missouri University and Station.—F. C. Bradford, assistant professor of horticulture and assistant horticulturist, resigned August 31 to accept a similar position at the Michigan College and Station.

Nebraska University and Station.—Dr. L. V. Skidmore has been transferred from assistant in animal pathology in the station wholly to college work. S. J. Marsden, assistant in poultry husbandry, has been transferred from the station to a position as instructor in poultry in the Nebraska Trades School, operated by the university.

R. A. Braun has been appointed as instructor in dairy husbandry, beginning July 1, to succeed J. W. Boehr, who has resigned to become extension specialist in dairying at the Oklahoma College. E. O. Anderson and Ray F. Morgan, assistants in dairy husbandry at the Minnesota and Idaho Stations, respectively, have been appointed instructors in dairy husbandry, effective August 1, succeeding B. H. Thompson and J. W. Hendrickson, resigned.

New Jersey College and Stations.—The annual summer field meeting was held at the college June 16 and 17, the first day being devoted to crops and live stock and the second to horticulture and poultry. Some of the special features of this year's meeting were a demonstration by the Ocean County Radio Association of radio for receiving market reports, weather forecasts, and other

information of interest to farmers; newly improved dusting machinery, motor cultivators, and a transplanting machine; and competitive dairy and swine judging contests. The new field crops plats attracted special attention.

The new poultry husbandry building is now ready for occupancy. Plans for the new dairy and animal husbandry building are being drawn, and it is expected that the contract will be let this fall.

Director J. G. Lipman has returned from a two months' trip throughout various countries of Europe. Dr. Lipman was one of the representatives of the United States at the International Institute of Agriculture at Rome and the International Soils Conference at Prague. He visited a number of European universities, giving lectures at the French Academy of Agriculture, the Universities of Cambridge and Oxford, the British Society of Chemical Industry, the Rothamsted Experimental Station, and the Southeastern Agricultural College at Wye. He also represented Rutgers College at the seven hundredth anniversary of the University of Padua, and was awarded a silver medal by the French Academy of Agriculture.

George W. Martin, assistant professor of botany, has received the degree of doctor of philosophy from the University of Chicago, where he has been on leave of absence. Henry Kellar, jr., a graduate of the Pennsylvania College in 1920 and subsequently engaged in graduate study at the University of Wisconsin, has been appointed assistant professor of economics in the college and agricultural economist in the station, beginning July 1.

Porto Rico University.—The Degetau Building, destroyed by fire October 11, 1918, has been rebuilt largely of reinforced concrete. Its completion and reequiptment will again permit of offering to a limited number of students laboratory courses in bacteriology, vegetable pathology, chemistry, and physics.

Rhode Island Station.—Henry B. Hall, Ph. D., has been appointed economist, a new position on the station staff. Mary E. Williams has resigned as assistant in animal breeding and pathology and has been succeeded by Ralph P. Tiftler, a 1922 graduate of the Pennsylvania College.

Virginia Station.—During the past year the station has installed and begun to operate a complete lysimeter equipment consisting of 63 tanks, for the purpose of studying the movement of different forms of lime and other plant food elements, using Hagerstown silt loam soil in the tanks.

T. L. Copley has been appointed superintendent of the Chatham County Substation, effective June 15, vice D. J. Berger, resigned. W. D. Saunders, professor of dairy and animal husbandry, and C. E. Seitz, agricultural engineer, have been assigned station duties on a part-time basis, beginning July 1. The former will carry on an investigation of the relative food value of milks of varying composition, and the latter will conduct drainage experiments.

American Association of Agricultural College Editors.—The tenth annual meeting of the association was held at the Virginia Polytechnic Institute June 27 to 30. Thirteen states and the U. S. Department of Agriculture were represented. Carl R. Woodward of New Jersey presided, discussing the subject *The Editor and His Relationship to Other Colleges and Station Workers* in his presidential address. In addresses of welcome made by President Julius A. Burruss and J. R. Hutcheson, State director of extension, appreciation was expressed of the service which the college editor is rendering in extending the influence of his institution.

The conference was largely devoted to a discussion of the relationships of the editor to other workers at the agricultural college and to outside cooperative agencies such as the country newspaper, the farm paper, and farmers' or-

ganizations. In this discussion the various cooperative agencies as well as the editors were represented.

College and experiment station workers discussed the desirability of giving wider and more general publicity to their activities, and the need of help on the part of State and county extension workers in getting good articles regarding their work written and effectively placed was expressed. It was pointed out that in planning college courses for the training of extension workers definite provision should be made for giving instruction in the writing and placing of informational and publicity material.

Attention was called to the large amount of free informational material on agricultural subjects which comes to the desk of the country editor from State and Federal sources and from commercial agencies. It was pointed out that the average editor is not specially trained in agriculture, so that even if he had the time—which he has not—he could not make a very satisfactory selection of the mass of printed and mimeographed material that comes to him. The value of a high class State agricultural news service to country newspapers was pointed out as best meeting the situation. The conference brought out the urgent need for a careful study of the use which is made of publications and informational material sent out by the Department of Agriculture and the agricultural colleges.

Representatives of farm papers present suggested that they could use to the best advantage special stories of accomplishments told by farmers and farm women themselves in simple direct language. The desirability of supplying good, original photographs with such stories was emphasized. Like the country newspaper the farm paper daily receives a mass of mimeographed and printed material from State and Federal sources which it can not advantageously use.

The matter of supplementing printed publications and information service through the use of motion pictures and radio was discussed. The association went on record as favoring the extension of these mediums of carrying information. The organization of State film libraries and the ownership of projection apparatus in local communities was recommended.

The securing and using of good pictures of agricultural work was discussed with much interest. The need and value of such pictures in illustrating high grade popular publications was generally appreciated.

The editors expressed themselves as extremely desirous of having made available for their reference the latest information developed as a result of investigations in agricultural economies. It was felt that they could shape up informational material more effectively if they could be kept in touch at regular intervals with developments in the agricultural situation throughout the country. It was suggested that the Department of Agriculture ought to make promptly available, if possible, information of this character which it might have.

A competitive exhibit of publications and informational matter by members of the association was an interesting feature of the meetings, sweepstakes for the best all around exhibit going to Ohio.

M. V. Atwood of New York was elected president and R. W. Green of North Carolina secretary and treasurer for the ensuing year. New Brunswick, N. J., was chosen as the next place of meeting.

Canadian Society of Technical Agriculturists.—The second annual convention of this society, held at Macdonald College June 26-30, was characterized by an attendance of over two hundred members, an interesting program and increased enthusiasm. The address of the retiring president, President L. S. Klink of the University of British Columbia, dealt with the steady and unin-

interrupted progress of the society since its formation in 1920, stating that it "has it within its power to become the great unifying and coordinating agency in agricultural thought and action in Canada."

One new feature of the meeting was a series of advanced lectures, extending over three days and arranged through the cooperation of the Dominion Department of Agriculture. One day was spent in visiting the Oka Agricultural Institute.

The new officers include J. B. Reynolds of the Ontario Agricultural College as president, Jules Simard of Quebec and H. Barton of Macdonald College as vice presidents, L. H. Newman of Ottawa as honorary secretary-treasurer, and Fred H. Gridley of Ottawa as general secretary. The 1923 convention is to be held at the University of Saskatchewan.

Polish Institute for Agricultural Research.—This Institute was founded by the Polish Government in 1918 for scientific research in agriculture. It is located at Pulaway and at present comprises divisions of plant production, plant pathology, veterinary medicine, biochemistry, agriculture, horticulture, animal breeding, animal feeding, entomology, bacteriology, and experimental morphology of animals. Publications are now being issued, the Polish language being used, but with short summaries in other languages.

Garden Plots for Spanish Schools.—The Spanish Government is endeavoring to establish a system of agricultural instruction in rural schools with a view to checking the growing exodus from country to town and reducing the emigration of land workers. Provision has been made for furnishing garden plots to these schools, a national subsidy of about \$200 each being available for rent and necessary expenses. The plots are to be from one to two hectares (2.5 to 5 acres) in size and are to be devoted to the plan for at least six years. The land is to be used for teaching the use of fertilizers, the influence of selected seed on the harvest, rotation of crops, soil preparation and the use of machinery, the local climate as affecting crops, and the use of a simple system of farm bookkeeping. It is also hoped to utilize the areas in the instruction of adults. Owing to the shortage of qualified teachers, it is thought that only a beginning can be made on the plan at present, but its wide extension is hoped for.

Agricultural Work in West China Union University.—It is expected to begin agricultural instruction in this institution in the near future. The work will be under the direction of Frank Dickinson, who has been in educational work in China for several years and is now studying agriculture at Cornell University. This will constitute the fourth agricultural institution recognized by the educational authorities in China under Christian auspices, those already under way being located in Peking, Nanking, and Canton. The West China University is located at Chengtu, contiguous to a territory inhabited by a population of one hundred million persons, and it is thought offers an exceptional opportunity.



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No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Annual reports on the progress of chemistry for 1921, edited by A. J. GREENAWAY (*Ann. Rpts Prog. Chem.* [London], 18 (1921), pp. X+257, pl. 1, figs. 8).—This is the usual annual report (E. S. R., 45, p. 610) of progress in various branches of chemistry.

Yearbook for agricultural chemistry, edited by F. MACH (*Jahresber. Agr. Chem.*, 4. ser., 2 (1919), pp. XXX+563).—This volume continues the series previously noted (E. S. R., 45, p. 410).

Chemist's calendar, I, II, W. ROTH (*Chemiker-Kalender*. Berlin: Julius Springer, 1922, vols. 1, pp. XIX+520, figs. 9; 2, pp. XII+624, pl. 1, figs. 52).—This is the revision for 1922 of the handbook previously noted (E. S. R., 45, p. 410).

The nitrogen distribution of proteins extracted by 0.2 per cent sodium hydroxid solution from cottonseed meal, the soy bean, and the coconut, W. G. FRIEDEMANN (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 17-20).—Data are presented from the Oklahoma Experiment Station on the nitrogen distribution, as determined by the Van Slyke method, of the proteins extracted from cottonseed meal, the soy bean, and the coconut by 0.2 per cent sodium hydroxid and, in the case of cottonseed meal, by 5 per cent barium hydroxid. The results obtained with the 0.2 per cent NaOH extract are given in the following table:

Nitrogen distribution in 0.2 per cent NaOH extract of cottonseed meal, soy bean, and coconut protein.

Ind of nitrogen	Cotton- seed meal	Soy bean	Coconut	Kind of nitrogen	Cotton- seed meal	Soy bean	
	Per cent.	Per cent.	Per cent.		Per cent.	Per cent.	
acid N.	10.54	11.31	7.52	Histidin N.	4.94	5.	5.60
amin N.	2.09	1.84	1.50	Lysin N.	5.10	8.	4.99
glut N.	1.11	1.04	.70	Amino N of filtrate	51.26	54.	47.18
guan N.	23.48	14.57	28.67	Nonamino N of filtrate	2.15	2.	2.94

Attention is called to the fact that the nitrogen distribution in these extracts is practically the same as the figures reported in the literature for the globulins of the same materials, with the exception that the arginin content of coconut protein is considerably higher than that reported by Johns et al. for coconut globulin (E. S. R., 40, p. 502).

Do the amino acids occur in cow's milk? Y. HIRAKATA (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 165-170).—The author reports the isolation of lysin, ar-

ghin, and histidin from a large volume of fresh cow's milk from which protein and lactose had been separated. It is thought that monamino acids are probably present also. In addition to the amino acids, guanin and adenin were found in the purin base fraction and cholin in the lysin fraction.

The determination of acid number of tung and other vegetable oils, L. L. STEELE and G. G. SWARD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 57, 58).—The investigation reported in this paper covers three points, the relative values of alcohol and alcohol-benzene as solvents in acid number determinations on vegetable oils, possible differences in the results obtained with sodium and potassium hydroxid, and differences between the use of aqueous and alcoholic alkali.

The data reported show that the use of alcohol alone as a solvent in the determination of the acid number of tung oil leads to low values, and that the alcohol-benzene mixture gives values which are correct within the limits of experimental accuracy. With linseed and cottonseed oils alcohol yields values on the average slightly lower than the theoretical acid content, and the alcohol-benzene mixture values closer to the theoretical. In addition to greater accuracy, the alcohol-benzene mixture is considered preferable to alcohol alone because the end point in the titration is much sharper.

No difference was noted between the use of sodium and potassium hydroxids. If the weight of the sample is so regulated that about 15 cc. of alkali is required for neutralization, aqueous alkali can be used interchangeably with alcoholic alkali, but in the case of materials with very high acid number alcoholic alkali should be used on account of hydrolysis with aqueous alkali.

The preparation of inulin, with special reference to artichoke tubers as a source, J. J. WILLAMAN (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 275-283, fig. 1).—Following a previous suggestion of the possibility of utilizing Jerusalem artichokes as a source of fructose (*E. S. R.*, 44, p. 313), the author at the Minnesota Experiment Station has made a study of methods of preparing inulin from the artichoke. The method found most promising is as follows:

The washed tubers are ground as fine as possible and placed in boiling water containing calcium carbonate, using 1,300 cc. of water and 30 gm. of calcium carbonate for each kilogram of tubers. The mixture is boiled for from 15 to 20 minutes, the juice extracted with a press, the residue reboiled with 1,000 cc. of water and 10 gm. of calcium carbonate, and extracted as above. The combined extracts are clarified with lead acetate, centrifuged or filtered, treated with ammonium oxalate to remove the lead, and centrifuged again. The liquid thus obtained is evaporated in vacuo to a content of from 40 to 60 per cent solids, cooled slowly, kept at from 0° to 5° C. for several hours, thoroughly stirred with an equal volume of ice water, and centrifuged. The crystals thus obtained are recrystallized from water, filtered, washed with cold water, alcohol, and ether, and dried in the oven at 100°.

For making fructose sirup the juice is extracted from the tubers by diffusion, clarified with lime, phosphoric acid, and decolorizing carbon, and subjected to acid hydrolysis. The fructose is then separated as calcium fructosate and the fructose recovered by decomposition.

An improved method for preparing raffinose, E. P. CLARK (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 1, pp. 210-213, fig. 1).—An improved method of preparing raffinose from cottonseed meal is described.

The meal is first extracted with water by percolation, the extract purified with lead acetate, and the excessive lead removed with oxalic acid. Active lime is then added to the extract to precipitate the raffinose as calcium raffinosate. This is filtered, washed, and the resulting cake placed in a deep narrow can about three-fourths full of water. With the aid of a special stirring

device, a diagram of which is given, the mixture is rapidly saturated with carbon dioxide. The solution is filtered hot, evaporated under diminished pressure to from 70 to 75 per cent total solids, and crystallized by the addition of alcohol.

The relation between chemical constitution and physiological action, A. OSWALD (*Schweiz. Chem. Ztg.*, 1921, Nos. 27, pp. 299-303; 29, pp. 325-329; 30, pp. 337-341).—A general discussion of the subject.

Modern ideas respecting acidity and alkalinity, N. EVERS and J. GAMBLE (*Amer. Jour. Pharm.*, 94 (1922), No. 4, pp. 274-289).—A concise discussion of the theory of H-ion concentration and its practical applications.

H-ion concentration studies on distilled water, physiologic sodium chloride, glucose, and other solutions used for intravenous medication, J. R. WILLIAMS and M. SWETT (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 14, pp. 1024-1026).—The authors advance the hypothesis that when fluids of a much higher or lower H-ion concentration than blood are introduced into the circulation at a rate or in an amount in excess of the capacity of the blood to neutralize them reactions characterized by chills and prostration follow. Similarly it is thought that soreness near the site of subcutaneous injections may be due to localized temporary tissue acidosis or alkalosis. This theory is based on clinical observations and on H-ion concentration determinations of solutions, the use of which has led to such reactions. The substances reported on in this paper are distilled water, glucose, and physiological salt solutions.

Data are presented showing that distilled water if not carefully prepared, or after being stored as a stock solution, becomes sufficiently acid that when used as a solvent it may produce a solution of a much higher H-ion concentration than that of the blood. Glucose solutions become acid when boiled or autoclaved or when allowed to stand for a few hours. Physiological salt solution when prepared with stock distilled water or with an impure salt may also be acid. It is shown that these solutions may be easily corrected to the proper H-ion concentration by the addition of buffer salts.

The practical application of buffers in the regulation of the H-ion concentration of intravenous solutions, R. H. MITTON, E. A. STAGLE, and S. F. ACREE (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 14, pp. 1026-1029).—This paper supplements the above by a discussion of the meaning of the term buffer action and of the scientific reasons for buffering injection fluids as suggested.

Influence of vacuum upon growth of some aerobic spore-bearing bacteria, L. D. BUSHNELL (*Jour. Bact.*, 7 (1922), No. 2, pp. 283-300).—Evidence is presented from the literature that the aerobic spore-bearing types of bacteria predominating in unspiced canned foods belong to the *Bacillus mesentericus* and the *B. subtilis* groups, with the former predominating. In an attempt to determine why *B. mesentericus* predominates, a series of experiments with the two types of organisms was carried out, the report of which makes up the body of this paper. The experiments included determinations of the influence of varying amounts of air, of salt and air, of acetic acid and air, and of other organisms on the growth of the two organisms in broth media.

From the results obtained, the author concludes that "*B. mesentericus* predominates in canned foods because it is capable of growing to some extent in the absence of air rather than because its spores are more heat resistant than some other types of aerobic bacteria. The amount of vacuum under which spores of these organisms are placed during the heating does not influence the thermal death point.

"The small amount of acid present had but slight retarding influence upon the growth of these organisms in air, but did have a marked influence upon the thermal death point. It may be that the beneficial influence of acid upon

the keeping of canned foods is due more to the lowering of the thermal death point than to the inhibition of growth of the organisms. The amount of air remaining above the liquid has little influence upon the growth of these bacteria, since sealing the tubes prevents all but minimum growth. This inhibiting influence is more marked in case of *B. subtilis* than in case of *B. mearnsii*." ¹

Desiccated nutrient media, W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 9 (1921), No. 2, pp. 364-368).—The authors have applied to the preparation of desiccated nutrient media the suggestion of Cunningham (E. S. R., 41, p. 614) of drying agar by passing it through a meat grinder and spreading the ground product in thin layers to facilitate drying. The agar is first cut in small pieces and saturated with a tryptic digest of mutton bouillon of a reaction of pH=8. After heating the mixture in the autoclave at 120° C. for one hour it is filtered in the autoclave through cotton, and when cold cut into slices and passed through a meat grinder with a finely perforated outlet disk, spread out in thin layers, and dried in the hot air oven. This dried medium can be used in preparing a nutrient fluid medium by extracting with water in the cold and rejecting the undissolved agar, or it can be melted and sloped in tubes for a solid medium, or it can be mixed with other substances in the dry state and then melted or dissolved for special media.

Official and tentative methods of analysis of the Association of Official Agricultural Chemists, compiled by R. E. DOOLITTLE ET AL. (*Washington, D. C.: Assoc. Off. Agr. Chemists*, 1921, 2. ed., pp. XII+417, figs. 18).—This is a reprint of the first edition (E. S. R., 44, p. 9).

The elements of fractional distillation, C. S. ROBINSON (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, pp. IX+205, figs. 44).—This volume, which has been designed as an introduction to the study of fractional distillation, deals with the principles of fractional distillation from the standpoint of physical chemistry and chemical engineering, with a few examples of modern distilling apparatus. An appendix contains a number of useful reference tables compiled from various sources and a bibliography on the subject covering the literature from 1906 to 1920, inclusive. It is stated that this volume will be followed by another dealing with the general practice of fractional distillation and its applications to various industries.

Titrations in ethyl alcohol as solvent, E. R. BISHOP, E. B. KITTREDGE, and J. H. HILDEBRAND (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 1, pp. 135-140, fig. 1).—Advantages in the use of alcohol as a solvent in acid-base titrations are pointed out, and data are presented on the color changes of various indicators in ethyl alcohol and on the titration values as shown in curves of various acids with sodium ethylate and of bases with hydrochloric acid. The possible applications of the data are illustrated by the titration of a fatty acid in the presence of its glycerid.

A continuous-reading electrotitration apparatus, K. H. GOODE (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 1, pp. 26-29, figs. 6).—The apparatus described employs a 3-electrode vacuum valve ("audion") which draws no current from the source to be measured and can, therefore, be employed as a continuous-reading instrument for determining H-ion concentration. The sensitivity of the apparatus as described is said to be of the order of 0.1 pH or 0.006 volt.

The Tyndallmeter reading of soil dispersoids.—Preliminary report, F. M. SCALES and F. W. MARSH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 52-54, fig. 1).—The Tyndallmeter, as perfected by Tolman and Vliet¹, has

¹ *Jour. Amer. Chem. Soc.*, 41 (1919), No. 3, pp. 297-300.

been utilized at the Bureau of Plant Industry, U. S. D. A., in the determination of the dispersoid content of soils by the suspension method. The technique of the method is described in detail.

A new colorimetric method for the determination of plasma proteins, H. WU (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 33-39).—In the method described the plasma proteins are separated essentially by the method of Cullen and Van Slyke (E. S. R., 43, p. 205), and are determined by the color reaction with the phospho-18-molybdictungstic acid reagent of Wu (E. S. R., 44, p. 112).

Separate analyses of the corpuscles and the plasma, H. WU (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 21-31).—Attention is called to the value of separate analyses of the corpuscles and plasma of the blood, and a method is described for the preparation of protein-free filtrates of the corpuscles and plasma suitable for all determinations included in the system of blood analysis of Pollin and Wu (E. S. R., 41, p. 13).

Data are given of the analysis by this method of 20 samples of normal human blood. The average distribution of nonprotein nitrogen calculated in milligrams per 100 cc. of corpuscles and plasma, respectively, is as follows: Urea N 17.10 and 19.30 mg., uric acid N 0.64 and 1.31, total creatinin N 3.10 and 0.55, and amino acid N 9.47 and 5.52 mg. The difference between the total nonprotein nitrogen calculated and determined was 19 mg. per 100 cc. in the case of corpuscles and 2.1 of the plasma. The author is of the opinion that this difference may be due to the presence of peptids and peptones in the corpuscles.

The concentration of sugar was usually higher in the corpuscles than in the plasma, but at times the reverse was true. The concentration of chlorids in the plasma was about twice that in the corpuscles. It is recommended in conclusion that plasma analysis be substituted for whole blood analysis.

Chemical test for heat-damaged wheat, W. L. FRANK (*Grain Dealers Jour.*, 48 (1922), No. 5, p. 321).—The test recommended is based on the assumption that damage in wheat from heat which has not been accompanied by the destruction of the adhesive or dough-making quality of the gluten in the individual kernel should not be considered heat damage, and consequently that the extent of heat damage can be determined by an examination of the kernels for gluten by the qualitative Bamihl test as described in the Official methods of analysis.

This test is considered of value in the case of "doubtful" kernels and of possible application as a quantitative method.

The determination of carbon dioxide in baking powder, C. S. ROBINSON and S. L. BANDEMER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 2, p. 119).—The method of determining carbon dioxide previously noted (E. S. R., 44, p. 203), which has been found practical for determining total CO_2 in baking powder, has been extended to the estimation of residual CO_2 in baking powder. The technique for total CO_2 is the same as that originally described for its determination in limestone except that 100 mg. samples are used. For residual CO_2 a 2-gm. sample of the well-mixed material is weighed into a small beaker. 20 cc. of distilled water is added, and the mixture is thoroughly stirred and allowed to stand for 20 minutes at room temperature and for the same length of time in a bath of boiling water. It is then boiled for 1 minute and diluted to 25 cc. in a volumetric flask, 1-cc. samples being used for the determination.

The detection and identification of maltose, galactose, saccharose, and inulin by a mycological method, A. CASTELLANI and F. E. TAYLOR (*Jour. Trop. Med. and Hyg.* [London], 25 (1922), No. 4, pp. 41-46, fig. 1).—Methods are described for the detection and identification of carbohydrates through their fermentation by different fungi and bacteria. Tables are given showing the gas

formation of various carbohydrates and glucosids in the presence of seven strains of *Monilia* and six bacilli. So-called mycological and chemico-mycological formulas are appended. The former indicate the most suitable organisms for identifying the more important carbohydrates and the latter a combination of mycological tests with Fehling's test.

The determination of glycerol in the presence of sugars, L. F. HOYT and H. V. PEMBERTON (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 54-56).—The method described, which is applicable particularly to the determination of glycerol in soap, depends upon the principle that sugars are completely oxidized in the presence of a large excess of potassium dichromate and sulphuric acid, and that consequently the amount of dichromate required to oxidize a given sample of a soap containing both glycerol and sugar is a measure of both of these substances. By determining the sugar present in a sample of the soap by the regular Munson and Walker method and calculating its equivalent in potassium dichromate, the difference between this figure and the original figure obtained on oxidation represents the glycerol.

The method is said to give very consistent and accurate results in the determination of glycerol in transparent soaps containing sugar and in nonalcoholic vanilla extract containing sugar. It is also thought to be applicable to the determination of glycerol in fermented products, but is not applicable in the presence of commercial glucose.

The use of vegetable decolorizing carbons, P. SMIT (*La. Planter*, 67 (1921), No. 5, pp. 76-79).—This is the report of a study of the relative efficiency of boneblack and activated vegetable carbons in the clarification of sugar, the results of which have led the author to replace a boneblack sugar-clarifying plant in Holland with a vegetable carbon plant.

Sugar refining in Louisiana with Norit, W. H. DUNSTONE, JR. (*La. Planter*, 68 (1922), No. 16, pp. 254-256).—A description is given of the refining of raw sugar with norit in a large sugar factory in Louisiana, this practice enabling the factory to be used the year around instead of for the short period of the sugar season. With the process as described, "it has been demonstrated beyond a doubt that a recovery of 93 lbs. of standard granulated sugar per 100 lbs. of 96-test raws can be obtained, and also that the process can be conducted on a commercially profitable scale."

The colloids of cane juice and their separation by means of Plauson's process of ultrafiltration (*Internatl. Sugar Jour.*, 23 (1921), No. 276, pp. 680-682, figs. 2).—A description, with illustration, of the Plauson ultrafilter (E. S. R., 44, p. 410), with suggestions for its use in the filtration of cane juice.

Pointers on the processing of spinach (*Canner*, 54 (1922), No. 18, p. 31).—This brief contribution from the research laboratory of the National Canners' Association discusses points to be observed in the canning of spinach. It is suggested that No. 1 cans be processed for 40 minutes at 240° C. and No. 2 cans for 55 minutes at 240° to insure the sterilization of the product.

Dehydration of sweet corn successful, W. A. NOEL (*Amer. Food Jour.*, 17 (1922), No. 4, pp. 7-9, figs. 5).—This is a brief description of methods employed in a number of commercial sweet corn dehydration plants. The driers described include those of the wire belt, compartment, and table types.

Use of enzymes in the clarification of jellies and fruit juices, S. A. WAKSMAN (*Canner*, 54 (1922), No. 18, pp. 45, 46).—The author, at the New Jersey Experiment Stations, suggests the use of the enzyme produced by *Aspergillus oryzae* to clarify the pectin extract from apple pomace which is used in making jelly. The method of preparing the extract is as follows:

Apple pulp or dried pomace is diffused with cold water to extract most of the sugar and acid, filtered, and the residue cooked for about 45 minutes in a

dilute tartaric acid solution (about 0.1 per cent). The juice is then pressed out, cooled to from 110 to 120° F., and treated with the concentrated enzym until the starch has been completely hydrolyzed as shown by the iodine test. The juice is then filtered to remove any suspended matter and concentrated in vacuo. It is stated that the pectin solution thus prepared will give a clear jelly free from any turbidity.

The refining of palm oil for edible purposes, M. L. LAURO and W. H. DICKHAET (*Amer. Jour. Pharm.*, 94 (1922), No. 4, pp. 245-249).—Data are presented on the refining of palm oil for edible use by methods commonly used in refining cottonseed and other edible oils. The crude oil was refined with 13.5 per cent of 18° B. caustic soda, with a loss of 23.5 per cent of the oil, bleached in shallow aluminum dishes for several days at a temperature of from 105° to 110° C., and deodorized by live steam. The resulting product had a rather sweet but not unpleasant taste. The analytical constants of the oil before and after refining were, respectively, as follows: Specific gravity at 99/15.5° C. 0.8556 and 0.8596, iodine number 54.3 and 53.2, saponification number 198.5 and 196.0, and index of refraction at 30° 1.4628 and 1.4634. The melting point of the refined oil (capillary method) was 48.8°. It gave a negative Halphen test for cottonseed oil and a negative Villavecchia test for sesame oil. The refined oil is thought to offer possibilities of extensive use in the manufacture of nut butters, margarin, and lard compounds.

Possibilities of the plant growth of the moist Tropics to furnish materials for liquid fuel, H. N. WHITEFORD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 2, pp. 151, 152).—This is an abstract of a paper presented before the section of cellulose chemistry at the meeting of the American Chemical Society at Rochester, N. Y., in April, 1921. Data are presented on the probable yield and cost of alcohol from bamboo, nipa palm, and cassava roots, with suggestions of the possibilities of alcohol production from other agricultural crops, including corn, rice, cotton, and sugar cane.

Bleaching, S. H. HIGGINS (*Manchester, Eng.: Univ. Press; New York: Longmans, Green & Co., 1921, pp. VII+137*).—This volume consists essentially of a review of the literature on cellulose bleaching which has been published during the years 1908-1920, inclusive.

The determination of the bromine figure or chlorine factor of pulp and the utilization of these quantities in bleaching, A. TINGLE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 40-42).—A study of possible methods of determining the amount of chlorine required to bleach different grades of sulphite spruce pulp has led to the establishment of a method depending upon the action between bromine and a solution of the pulp in a given period of time, 30 minutes. It was found that if the pulp is brought into solution in hydrochloric and sulphuric acids the reaction between the bromine and the pulp appears to proceed in definite steps, one of which is completed in 30 minutes. The bromine figure or the amount of bromine reacting in 30 minutes has been found to be a fairly definite constant for any particular pulp.

A more convenient factor for actual use is the so-called chlorine factor, which is defined as the weight of chlorine equivalent to the bromine reacting with 100 parts of pulp in 30 minutes or

$$\frac{100 \times 0.0035 \times \text{cc. of } N/10 \text{ Br consumed}}{\text{weight of pulp sample}}$$

The chlorine factor multiplied by a constant K, which may vary according to the practice of different mills, is thought to represent fairly accurately the actual weight of chlorine required to bleach 100 lbs. dry weight of the pulp.

For the mill at which the experimental work was done, $K=3$. The technique of the method is described in detail, with an example of the calculation of results.

Effect of adding various chemicals to wood previous to distillation, I. F. HAWLEY (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 43, 44).—The investigation reported in this paper is essentially a continuation of the work of Palmer on the effect of catalyzers on the yield of products in the destructive distillation of birch wood (*E. S. R.*, 38, p. 808). In the first of the experiments reported, the sawdust was mixed with the material to be tested, if insoluble, or saturated with a solution of the material and dried, and then pressed into briquets and distilled according to the method described in a previous paper (*E. S. R.*, 45, p. 613). The silver maple and white oak sawdust were treated in turn with phosphoric acid, lime, calcium carbonate, and sodium carbonate in different concentrations, and determinations made of the percentage of alcohol and acetic acid obtained on distillation.

Of the various substances tested, sodium carbonate alone gave promising results when added in small amounts. The addition of 1.5 per cent of sodium carbonate resulted in a large increase in alcohol, with no increase in acid, while larger amounts tended to decrease both alcohol and acid.

Attempts to apply this treatment to wood in large sizes proved less successful. Blocks of wood 6 in. long were treated with a solution of carbonate under 100 lbs. pressure and then distilled. With oak blocks a 50 per cent increase in wood alcohol, with no increase in acid, was obtained in one series of runs, using 1.03 per cent carbonate. When 0.52 per cent carbonate was used there was a slight decrease in the acid. In the case of maple blocks there was a pronounced increase of alcohol with 0.68 and 1.12 per cent of carbonate, but a considerable decrease in acetic acid. On account of the difficulty in the impregnation of wood with the carbonate, such treatment previous to distillation is considered to be most feasible in connection with processes for the distillation of sawdust rather than of wood.

The chemical changes involved during infection and decay of wood and wood pulp, M. W. BRAY and J. A. STAHL (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 35-40, fig. 1).—Chemical analyses are reported from the U. S. D. A. Forest Products Laboratory at Madison, Wis., of samples of sound white spruce wood from various localities, of infected spruce woods, and of the corresponding sulphite and soda pulps of a typical sound white spruce and of the infected spruce woods.

The inferiority of the infected woods over the sound woods is due to an increase in the cold and hot water-soluble materials during decay; an increase in the alkali-soluble materials showing a lower resistance to the action of chemical reagents; an increase in the copper number showing that the infected wood contains a larger amount of reducing compounds; and a lower percentage of α - or stable cellulose and a higher percentage of β - or less stable cellulose. These factors tend to decrease the amount of satisfactory pulp which can be obtained from the decayed wood.

Textile raw materials and their conversion into yarns, J. ZIESSER, trans. and rev. by D. T. NISBET (*London: Scott, Greenwood & Son, 1921, 2. ed., rev. and enl., pp. VIII+478, figs. [309]*).—This textbook deals with the study of materials and the technology of spinning, describing the derivation, origin, cultivation, collection, form, structure, and characteristics of animal and vegetable raw materials, as well as their utilization and conversion into yarn. Such mineral raw materials as are converted into weaving material in other ways are similarly treated.

METEOROLOGY.

Forecasting the crops from the weather, C. F. BROOKS (*Geogr. Rev.*, 12 (1922), No. 2, pp. 305-307).—Reviewing the more recent contributions to this subject by various investigators, the author concludes that “with adequate knowledge of the detailed relationship of the weather elements to the condition of crops we could modify farm practice as regards planting in order to bring a critical stage of the crop at a time most likely to have favorable weather. With forecasts even for a few months in advance, substitute crops could be raised to prevent an imminent crop failure, or at least steps could be taken in advance of a crisis to insure sufficient food supply. Few investigations hold out such promise of valuable preharvest safeguards against a threatened scarcity of food.”

Amplified local forecasts for farmers (*Bul. Amer. Met. Soc.*, 3 (1922), No. 6, p. 89).—The U. S. D. A. Weather Bureau office at Lansing, Mich., issues each morning “an amplification of the regular 36-hour forecast, giving in brief an idea of the general character of weather to be expected for from two to four days in advance.” This is distributed through the county agricultural agents and “has proved of great value to agricultural interests, who are thus enabled to obtain a fairly accurate idea of the advisability of performing certain work.”

Weather insurance, A. H. PALMER (*Bul. Amer. Met. Soc.*, 3 (1922), No. 5, pp. 67-70).—The development and advantages of weather insurance are discussed, its importance from the standpoint of the farmer being specially emphasized. It is stated that “80 per cent of all damage sustained by growing crops is caused by unfavorable weather. The weather is a greater factor in successful agriculture than all other influences put together.” The author believes that “the increased use of weather insurance will aid in guaranteeing perpetual prosperity to agriculture, and thus help to stabilize business in general.”

Circulation of the atmosphere in the middle latitude of the earth, A. DEFANT (*Geografiska Ann.*, 3 (1921), No. 3, pp. 209-266, figs 4; rev. in *Nature* [London], 109 (1922), No. 2737, pp. 469, 470).—This article is, in the words of the reviewer, Sir Napier Shaw, “an attempt . . . to use the turbulence of the cyclonic depressions of middle latitudes to explain the distribution of temperature over the earth's surface and suggest explanations of climatic oscillations without entering at all into the details of the turbulent motion by which the effects are produced. It is an important and suggestive chapter in a new volume of meteorological theory.” The exposition is largely mathematical and can not be adequately set forth in an abstract.

The vacuum-pyrheliometer and the solar-radiation, F. H. BIGELOW (*Vienna: [New York: John Wiley & Sons], 1922, pp. VI+40, figs 9*).—The studies, of which those here reported are a part, led the author to conclude that “in the earth's atmosphere there are two different temperature systems, the first being the total solar radiation as it is measured by the vacuum pyrliometer. The second is the partial air temperature as measured by common thermometers.”

Referring to the fact that “climatology discusses the effects of local rain and air temperature upon the growth of plants, vegetation, and trees,” the author maintains that “this basis is erroneous because botanical and agricultural products depend actually upon the solar-radiation temperature, which is about 60° higher than the temperature of the air. The latter thermal efficiency would destroy all sorts of development of this kind.”

The influence of forests on run-off, SCHUBERT (*Met. Ztschr. [Brunswick]*, 39 (1922), No. 1, pp. 18, 19).—This is a brief discussion of the work of Engler, previously noted (E. S. R., 44, p. 417).

The phenology of Nova Scotia, 1918, A. H. MACKAY (*Nova Scotian Inst. Sci. Proc. and Trans.*, 15 (1918-1919), No. 1, pp. 49-56, fig. 1).—This is a summary of observations made by school children as a part of the prescribed nature study work. It includes observations on both wild and crop plants. Only those records which showed evidence of care and accuracy are included in the summary.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 399-400 (1922), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1922, are presented. The data are briefly discussed in general notes on the weather of each month.

Meteorological observations in Brazil, S. FLERAZ (*Boletim de Normas. [Rio de Janeiro]: Min. Agr., Indus. e Com., Dir. Met., 1922, pp. VIII+66*).—This is a detailed tabular summary of observations on temperature, pressure, precipitation, evaporation, humidity, winds, and clouds at Rio de Janeiro and at other places in Brazil under the direction of the national meteorological service for 1920 and preceding years.

Annual report of the [Philippine] Weather Bureau for the year 1918 ([*Philippine*] *Weather Bur., Ann. Rpt., 1918, pt. 3, pp. 353*).—This is a detailed tabular summary of meteorological observations at the secondary stations of the Philippine meteorological service on pressure, temperature, humidity, rainfall, wind, and clouds.

SOILS—FERTILIZERS.

Soil analysis and soil and plant interrelations, D. R. HOAGLAND (*California Sta. Circ.* 235 (1922), pp. 7).—A summary of the results of studies from different sources, but more especially from the station, is given, from which the conclusion is drawn that an estimate of the amounts of plant nutrients withdrawn from the soil by crops furnishes no scientific basis for soil treatment. It is further concluded that neither the analysis of the crop nor of the soil affords the essential information concerning availability of plant nutrients in soil at various periods and that consequently such data can not serve as a reliable guide in soil management. It is pointed out that in any discussion of relations of soils and plants, reference must be made to the importance of such factors as light, temperature, humidity, total soil moisture, and soil aeration. If a maximum crop is to be produced, there must be suitable adjustment between all the factors involved.

Report of the second meeting of the American Association of Soil Survey Workers (*Amer. Assoc. Soil Survey Workers Rpt.*, 2 (1921), pp. [2]+31, pl. 1).—The proceedings of this meeting, held at East Lansing, Mich., on November 18, 1921, include the following special articles: Report of Committee on Soil Color Standards, by J. G. Hutton; To What Extent Does the Soil Type Indicate Agricultural Value and Fertilizer Requirements? by R. S. Smith; Soil Classification, by C. F. Marbut; Further Improvements in the Work of the Soil Survey, by A. R. Whitson; The Correlation of Weathered Transported Soils, by C. F. Shaw; Laboratory Methods of Value to Soil Survey, by M. M. McCool; The Soil Survey and Its Relation to Canadian Agriculture, by A. H. Hawkins; Soil Survey Problems of the Canadian West, by R. P. Hansen; Soil Survey Problems of Eastern United States, by A. L. Patrick; Soil Survey

Problems of the Southern States, by J. F. Stroud; Early Definition of Soil Types, by F. J. Alway and P. R. McMiller; and A New Speedometer for Soil Survey Work, by T. M. Bushnell and L. A. Wolfanger.

Agro-geological bibliography, A. WOLF (*Ned. Landbouwhoogsch. [Wageningen]*, 20 (1921), pp. [1]+285).—This is an extensive bibliography on the subject consisting mostly of references to foreign works.

Soil survey of Iowa—Hamilton County, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt.* 20 (1921), pp. 54, pl. 1, figs. 11).—This survey deals with the soils of an area of 364,800 acres in central Iowa, lying entirely within the Wisconsin drift soil area. The topography of the county is level to very gently undulating, but locally there are many variations from this typical condition and the level prairies are broken by precipitous slopes. While the county as a whole is more or less adequately drained, many areas are said to be inadequately drained, and there are numerous low sags and ponded areas which will not be properly productive until drained.

The soils of the county are classed as drift, terrace, and swamp and bottomland soils, the drift soils covering over 96 per cent of the total area. Including peat, muck, and meadow, 15 soil types of 8 series are mapped, of which the Webster, Carrington, and Clarion loams cover 58, 15.8, and 12 per cent of the area, respectively.

Chemical analyses and field and greenhouse experiments to determine the fertility requirements and crop adaptations of the prevailing soil types are also reported. These indicate that the phosphorus supply in the soils of the county is rather low, and that the soils are not strikingly deficient in nitrogen. The use of complete commercial fertilizers is not recommended on these soils. Several of the soil types are said to be well supplied with inorganic carbon, and the soils which are acid in reaction require only small applications of lime.

Soil survey of Iowa—Louisa County, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpt.* 21 (1921), pp. 70, pl. 1, figs. 12).—This survey deals with the soils of an area of 253,440 acres in southeastern Iowa lying partly in the Mississippi loess and partly in the southern Iowa loess soil areas. The surface of the county consists in general of two areas of upland plains and two belts of low bottomland.

The soils of the county are said to be in general adequately drained. There are some of the types, however, that would be benefited by drainage, and there are small areas which are inadequately drained. The soils of the county are classed as loess, terrace, and swamp and bottomland soils, the loess soils covering 56.8 per cent of the area. Including riverwash and muck 29 soil types of 13 series are mapped, of which the Clinton, Tama, and Grundy silt loams cover 17, 10.5, and 10.4 per cent of the area, respectively.

Chemical analyses and field greenhouse experiments to determine the fertility requirements and crop adaptations of the prevailing soil types are also reported. These show that the soils of the county are practically all acid in reaction, and that the supply of organic matter and phosphorus is low. The total nitrogen content of the soils of the county is much more variable than that of phosphorus, and while the soils are not strikingly deficient in nitrogen, in many cases this element should be considered in systems of soil fertility.

The silt loam soils of eastern Washington and their management, F. J. SIEVERS and H. F. HOLTZ (*Washington Sta. Bul.* 166 (1922), pp. 62, figs. 26).—This report deals with the general characteristics of the silt loam soils in eastern Washington receiving more than 15 in. of rainfall annually, and reports investigations on their proper management. These silt loam soils are said to be fertile as compared to many of the representative silt loam soils in

the United States. Available nitrogen and not moisture is said to be the limiting factor in crop production, and summer fallow tillage is practiced to make nitrogen available for the next crop. The most effective summer fallow tillage has been found to be that which keeps the highest amount of moisture in the surface foot of soil for the greatest length of time during the summer fallow year.

It has been found that corn or any other intertilled crop, when substituted for summer fallow, does not materially reduce the yield of the succeeding grain crop. The amount of tillering of small grain was found to be directly affected by the amount of nitrate nitrogen in the surface soil during the tillering stage. The value of summer fallow tillage was most pronounced when winter grain was seeded sufficiently early to allow time for tillering. The quality of wheat is said to be directly affected by the nitrate content of the soil, irrespective of variety.

During 39 years of cropping 22.1 per cent of the nitrogen and 34.5 per cent of the organic matter were lost from the soil, and the loss of nitrogen from the soil was not nearly all accounted for in the crops removed. It is thought that the moisture conserved by summer fallowing has been sufficient to make soil leaching possible, resulting in the loss of large amounts of plant nutrients. Dry summers make it difficult for straw or other organic materials low in nitrogen to decompose in the soil unless summer fallowing is practiced. The rapid destruction of soil organic matter effected by summer fallow tillage is said to produce a poor physical condition of the soil.

The return of straw to the soil has a depressing effect on nitrate accumulation, which is more pronounced when the nitrogen content of such material is less than 2.25 per cent and when the soils are deficient in nitrogen and organic matter. Fresh straw manure when applied to soil had practically the same depressing effect on nitrate accumulation as straw. It was found that the amount of organic matter in soil can not be increased as rapidly by the addition of residues low in nitrogen as by the addition of those materials having a higher nitrogen content. Straw and strawy manure were, therefore, found to be limited in their value for the maintenance of organic matter in soil.

It was found that a legume crop introduced in the place of a summer fallow benefited the succeeding grain crop as much as an average summer fallow tillage. Summer fallow was found to be unnecessary where the annual rainfall is 18 in. or more, provided legumes or intertilled crops are grown in rotation. No continuous cropping system is recommended for that portion of the area where the annual precipitation is less than 18 in.

The influence of growing plants upon oxidation processes in the soil. J. R. NELLER (*Soil Sci.*, 13 (1922), No. 3, pp. 139-159, figs. 3).—Experiments conducted at the New Jersey Experiment Stations to determine the influence of growing plants upon the oxidation activities taking place in soil and specially prepared sand cultures, as indicated by quantitative measurements of the total carbon dioxide liberated, are reported.

Special apparatus was devised by means of which the total carbon dioxide liberated by the oxidation processes taking place in the substrata employed during the periods of plant growth could be measured quantitatively. This involved the complete exclusion of atmospheric carbon dioxide. That portion of the total carbon dioxide evolved from the soil which was fixed by the plants in the photosynthetic processes was determined by analyses of the plants for total carbon. The remainder of the total carbon dioxide was retained in absorption towers containing barium hydroxide and was quantitatively determined.

It was found that the oxidation processes in sand cultures to which organic matter was added were accelerated by growing green plants, the average total

carbon dioxid recovery from the planted cultures being 12.1 per cent higher than that from the unplanted check cultures. Growing plants very greatly increased the oxidation processes in a soil of average productiveness, as indicated by the total carbon dioxid produced. The average total amounts of carbon dioxid recovered from cultures planted with buckwheat, field peas, and soy beans were 116.5, 70.8, and 60 per cent greater, respectively, than were the corresponding amounts recovered from the unplanted check cultures.

During the growth of a second crop of soy beans on the same soil the increase in the oxidation activities over those exhibited in the unplanted soil was more pronounced than it was during the growth of the first crop.

All the experimental evidence obtained indicated that growing plants of buckwheat, barley, soy beans, and field peas have a beneficial influence upon oxidation activities in the substrata in which the plants are grown, and suggested a symbiotic relationship between the soil-oxidizing organisms and the growing green plants.

Equilibrium studies with certain acids and minerals and their probable relation to the decomposition of minerals by bacteria. D. WRIGHT, JR. (*Calif. Univ. Pubs. Agr. Sci.*, 4 (1922), No. 10, pp. 245-337, figs. 35).—In a contribution from the University of California studies of solution and disintegration of minerals by the action of end products of bacterial activity are reported.

In this work equilibria of certain minerals and various concentrations of acids and equilibria of the same minerals with solutions in which bacteria were producing acid were studied. It was found that the reactions occurring in the bacterial series conformed with the same formula as did reactions occurring in the mineral-acid series. The results suggested that a general relation exists between the initial hydrogen-ion concentration of the acid and the amount of material which the acid brings into solution when in contact with a mineral. It is concluded that the action of acid bacterial end products upon minerals is explainable as a chemical reaction.

Nitrogen economy in soils. F. E. BEAR (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 136-152).—In a contribution from the Ohio State University a summary is given of the results of a number of different studies on nitrogen in rain water, symbiotic and nonsymbiotic fixation of atmospheric nitrogen, and of the income and outgo of soil nitrogen as indicated by the lysimeter method.

The conclusion is drawn that the point of equilibrium between nitrogen income and outgo in soils varies with many factors, important among which are temperature, rainfall, soil reaction, cropping system, fertilizer treatment, and soil texture. In northern latitudes with a cool climate the nitrifying process is slower, but there is considered to be undoubtedly a corresponding reduction in the rate of nitrogen fixation. In southern latitudes nitrification is more rapid, and, with indifferent cropping systems, the total nitrogen content of the soil may be reduced to a very low point.

As the soil reaction becomes increasingly acid, the rate of nitrification and of nitrogen fixation is reduced. It is thought that the most rapid combined fixation will occur under conditions in which the soil is kept neutral or slightly alkaline in reaction, and in which the crop rotation has included regularly a legume crop which has been stimulated to large growth by the use of phosphate and potash fertilizers. The evidence indicates that the nonsymbiotic fixation processes are responsible for a considerable part of the nitrogen fixed under field conditions.

It is stated that under what might be considered average cropping systems, the nitrogen gains and losses in the average soil in the latitude of Ohio apparently come to equilibrium at a nitrogen content of from 2,000 to 3,000 lbs. of nitrogen per 2,000,000 lbs. of surface soil. The use of phosphate and potash

fertilizers apparently enables the nitrogen-fixing organisms to satisfy the nitrogen requirements of larger crop yields, but if the crops are removed the point of equilibrium in the soil is disturbed but little. If there is an accumulation of phosphorus, the point of equilibrium will be raised to correspond to the increased content of this element.

Intertillage of crops and formation of nitrates in soil, T. L. LYON (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 97-109, figs. 8).—In a contribution from the New York State College of Agriculture, studies conducted during two years on a sandy clay loam soil to ascertain the effect of cultivating, scraping, and mulching with straw on the nitrate content of unplanted soil and on the yields of corn are reported.

The nitrate contents were highest during both years in the soils of the cultivated plats, followed in order by those in the soils on the scraped and mulched plats. Moisture determinations indicated that the higher nitrate content of the cultivated plats was not due to moisture as that constituent was practically the same in the cultivated and scraped soils. The mulched soils had the highest moisture content.

The corn yields were greater on the mulched than on the scraped plats, but this could not be attributed to the larger supply of nitrate nitrogen as the mulched plats contained less nitrates than the scraped plats. This is taken to indicate that the productivity of the soil is not always proportional to its capacity for nitrate production.

The evidence presented is in favor of the assumption that the nitrate content of the cultivated soils is higher than that of the scraped soils because of the aeration produced by stirring with the cultivator. Cylinders of soil taken from the field without disturbing the soil structure nitrified only slightly on standing at a moisture content and temperature favorable to the formation of nitrates, while similar soil that had been aerated gave a larger increase in nitrates. Under similar conditions a cylinder of soil from a more compact part of the field nitrified less than did one from a less compact section.

Cultivation and nitrogen fertilization, H. A. NOYES, J. H. MARTSOFF, and H. T. KING (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 299-302).—In a contribution from the Mellon Institute of Industrial Research, studies are reported to determine the effectiveness of second applications of nitrogenous fertilizer to vineyard soils at the time of blossoming as indicated by the amount of nitrates present in the soil under different vineyard conditions. It is noted that in the Chautauqua and Erie grape belt, where two applications are made, the first is made at the time of plowing.

Experiments carried on under conditions of ample aeration showed that the nitrates tend to increase in proportion to the active organic matter present in the soil, and that a growing crop has an effect on the nitrates present. Early applications of sodium nitrate and proper cultivation were found to result in the presence of considerable quantities of nitrate in vineyard soils at the time second applications are often made.

Turning under cover crops in vineyards in the spring increased the nitrate content of the soil. Nitrates were found in quantity in these soils at regular intervals during the growing season, except at the start.

The results are taken to indicate that an application of available nitrogen at plowing time should be sufficient for properly cultivated vineyard soils.

An investigation on nitrification and denitrification in tropical soils, F. C. GERRETSEN (*Arch. Suikerindus. Nederland. Indië*, 29 (1921), Nos. 43, pp. 1397-1460; 44 pp. 1461-1530, pls. 7, figs. 14; also *Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser.*, No. 3 [1921], pp. 136, pls. 7, figs. 14; abs. in *Chem.*

Zentbl., 1922, 11, No. 5, pp. 255, 256).—The results of an extended series of studies are reported, which are taken to indicate that the phenomena of nitrification and denitrification are of great importance to the productiveness of Java sugar cane soils.

Studies of the factors which influence nitrification in these soils showed that the occurrence of a strong nitrite reaction was completely governed by the H-ion concentration of the culture medium. No nitrite occurred with a pH value of 7.2, but it did occur at a pH value of from 3.9 to 4.4.

The so-called Sarapan or gravel soils showed the best nitrifying power. Ammonium sulphate added to sand soils was for the most part retained in the top layer of from 10 to 20 cm. (4 to 8 in.) when the clay content was only about 10 per cent. In liquid cultures a concentration of ammonium sulphate of from 1.5 to 2 per cent prevented the further development of nitrifying bacteria. This limiting concentration of ammonium sulphate varied in different soils. In ordinary sand soils the highest nitrate content was obtained with 1 per cent of ammonium sulphate, while in the strongly absorbent gravel soil a concentration of 4 per cent of ammonium sulphate resulted in nitrification amounting to 90 per cent of the maximum. After nitrification it was found that 81 and 54 per cent of the added ammonia nitrogen could be leached as nitrate out of the gravel and light clay soils, respectively, while before nitrification these losses amounted to only 1.1 and 2.1 per cent, respectively. It is concluded that ammonium sulphate should be added to light clay soils in small amounts and at intervals rather than in one large amount.

Studies on the relations between the nitrifying power of soils and the growth of crops showed that the nitrifying powers of different soil types can vary widely without injuring their productiveness. It is concluded that the value of nitrifying power as a direct cause of soil productiveness has been much overestimated by others, although it is admitted that in many tropical soils a good stand of cane usually accompanies good nitrifying power. On the other hand it was found that very little nitrification takes place in productive rice soils, and that rice uses ammonia as its main source of nitrogen.

Studies of denitrification led to the conclusion that in tropical soils a great part of the nitrate nitrogen is lost through denitrification, especially where they are flooded.

The effect of drying soils on the water-soluble constituents, A. F. GUSTAFSON (*Soil Sci.*, 13 (1922), No. 3, pp. 173-213).—In a contribution from the New York Cornell Experiment Station, a review is given of work by others bearing on the subject, and studies on the effects of drying and heating soils at 105° C. on the amount of total water-soluble solids recoverable by extraction with distilled water are reported.

It was found that oven drying increased to a marked degree the quantity of water-soluble material removed from soil by 1:5 extraction with distilled water. Air-drying swamp soils increased the water-soluble material, and oven-drying this air-dried soil brought about a still further increase.

Storing soils for nine weeks at 8 to 12° in open jars, in which water evaporated was restored each week, or in sealed tubes in its original condition did not markedly affect the total soluble material. Nitrification occurred in the open jars, while nitrates decreased as a rule in the sealed tubes.

Keeping soil at room temperature and optimum moisture content for nine weeks did not materially affect the amount of soluble material, but there was a slight increase in all soils except white silt loam. Keeping these soils saturated at the same temperature greatly increased the soluble material. In the first case nitrification was active, while in the latter denitrification was com-

plete. Oven drying decreased the nitrate content of these soils. When potassium nitrate in two concentrations was added to four grades of quartz, it was not wholly recovered in one or even two 1:5 distilled water extractions. From the more dilute solution from 67 to 80 per cent of the nitrate was recovered in one extraction, while from the more concentrated 77 to 95 per cent was recovered. When potassium nitrate in a dish was heated in an oven at 105° for eight hours, after being evaporated to dryness, a distinct loss of nitrate occurred.

These results are taken to indicate that in planning soil biology studies, pot cultures, or other greenhouse fertility investigations, the soils used should be kept under conditions strictly comparable as to aeration, moisture content, and temperature in order to avoid the introduction of uncontrolled factors which might lead to erroneous conclusions.

Viable legume bacteria in sun-dried soil, W. A. ALBRECHT (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 1-2, pp. 49-51).—Studies at the Missouri Experiment Station to determine the influence of sunlight on the efficiency of infected soil as an inoculating agent are reported. Four fertile silt loam soils of two different types, each of which produced good crops of thoroughly inoculated red clover and soy beans one year, were used.

It was found that the *Pseudomonas radicolica* was effective for inoculating the following seeding, whether the soil containing it was dried in the absence or in the presence of direct sunlight, and that the dried soil stored for 30 months was as good for inoculating purposes as the fresh moist soil gathered from the field.

These results are taken to indicate that direct sunlight and desiccation are not so destructive to this organism in its native habitat as has been stated. Even though some of the legume bacteria may be killed when the infected soil is exposed to the sun, the number of them so destroyed is not great enough to impair seriously the efficiency of such soil as an inoculating culture.

Sterilization and disinfection of soil, P. WAGUET (*Rev. Prod. Chim. [Paris]*, 23 (1920), No. 22, pp. 655-658; 24 (1921), Nos. 4, pp. 115-118; 6, pp. 183-187).—A summary of investigations on the subject is given, together with a discussion of the theories advanced from different sources as to what actually takes place in the soil during and after disinfection and sterilization by different means. It is admitted that partial sterilization at least has a beneficial influence upon the productiveness of certain soils, but no specific conclusions are drawn as to the reasons therefor.

Soil improvement and economical crop production, N. E. WINTERS (*Clemson Agr. Col. S. C., Ext. Bul.* 51 (1922), pp. 27, figs. 14).—Practical information is given on the control of soil moisture, increasing and maintaining the supply of organic matter in soil, deep plowing and thorough tillage, and systematic and intelligent use of lime and fertilizers as important factors in soil improvement and economical crop production, with particular reference to conditions in South Carolina.

Soil fertility work, H. B. BROWN and J. F. O'KELLY (*Mississippi Sta. Rpt.* 1921, pp. 17, 18).—Tests of various crop rotations in progress for 11 years showed that on plats cropped to corn continuously, cowpeas planted at the last cultivation gave an increase of 7.7 bu. of corn per acre. Cowpeas and manure applied the year before gave an increase of 9.8 bu. per acre on soil naturally less fertile than the check plat. The plat in oats and vetch and cowpeas continuously yielded 639 lbs. more oats and vetch per acre than the average plats in rotations containing corn and cotton. Plats in cotton continuously yielded 767 lbs. more seed cotton per acre where 5 tons of manure were applied an-

nually. Where oats and vetch and cowpeas were in a rotation, corn made 8.4 bu. per acre more than in a corn-cotton rotation.

An experiment to determine the relative value of cowpeas, soy beans, and velvet beans for increasing soil fertility, both when used alone and when planted in corn, showed that the plats from which the legumes were not removed yielded more than 50 per cent more wheat than the ones from which they were removed. The legume-bearing plats yielded 43 per cent more wheat than the ones which had no legumes.

[**Green manuring**], C. F. BRISCOE (*Mississippi Sta. Rpt. 1921, pp. 25, 26*).—Three years' experiments on a poor sandy soil to compare the fertilizing value of forest leaves, green manure, and stable manure on oats showed that during the first year corn stalks, forest leaves, and pine leaves had practically no effect. The next year they all gave an increase over the previous year, while alfalfa, cotton stalks, and stable manure all showed a decided decrease. This is attributed to the rapid decay of the alfalfa, cotton stalks, and stable manure and the slow decay of the corn stalks and leaves.

In an experiment to determine the limit to the amount of green manure that can be turned and still produce an increase of crop, it was found that 40 tons of alfalfa turned under gave a larger crop of oats than 60 tons. The addition of lime with 60 tons of alfalfa caused a large increase. This is taken to indicate that one factor causing decrease where large amounts are turned under is acidity. A part of the decrease is also due to lack of moisture, since the heavy mass of 60 tons of alfalfa prevented the penetration of water.

Green manuring table, M. HOFFMANN (*Arb. Deut. Landw. Gesell., No. 311 (1921), pp. 12, pl. 1*).—Colored graphs are presented showing the average amounts of plant nutrients which may be produced in the soil by green manuring as compared with those resulting from the use of stable manure. Data are also given on the composition of the more important green manuring crops.

Fertilizer work, H. B. BROWN and J. F. O'KELLY (*Mississippi Sta. Rpt. 1921, pp. 16, 17*).—Studies by I. P. Trotter with various phosphorus fertilizers on cotton showed that it is unprofitable to use acid phosphate, raw rock phosphate, Florida soft phosphate, and duplex basic phosphate on the valley soil at the station farm. Raw rock phosphate and flowers of sulphur when used separately appeared to have a depressing effect, but when used together gave a considerable gain. Stable manure used for comparison gave very profitable gains both with and without raw rock phosphate.

Comparative tests of sodium nitrate, ammonium nitrate, and calcium cyanamid on corn when applied at rates of 100 and 200 lbs. per acre showed that sodium nitrate gave the best results, followed in order by the ammonium nitrate and cyanamid. An application of 200 lbs. per acre gave better gains than 100 lbs. but was not as profitable.

It is stated that the use of lime in a rotation of cotton, corn, oats, and a legume did not show any consistent gain for any form or amount of lime used.

Availability of some nitrogenous and phosphatic materials, G. S. FRAPS (*Texas Sta. Bul. 287 (1922), pp. 5-16, figs. 2*).—Tests of various materials containing plant nutrients to determine the availability of the latter are reported.

The nitrogen of charred wheat was found to have little fertilizing value. While calcium carbonate increased the nitrification of cottonseed meal in soils, in two cases there was a decrease in the amount of nitrogen assimilated by plants and in one case a slight increase. The nitrogen in cyanamid averaged about 10 per cent more available than that in cottonseed meal in tests on six soils. The nitrogen of muck tankage was about 10 per cent and that of horn and hoof meal about 84 per cent as available as that of cottonseed meal.

In a test on one soil the phosphoric acid of rock phosphate was not assimilated. The phosphoric acid of vivianite was about one-third, that of triplite about one-fourth, and that of wavelite and dufrenite about one-tenth as available as the phosphoric acid of acid phosphate. Starch decreased the assimilation of phosphoric acid. Calcium carbonate slightly decreased the assimilation of phosphoric acid from acid phosphate, vivianite, and wavelite, and slightly increased that assimilated from dufrenite. It caused a decided increase of the assimilation of phosphoric acid from triplite. Siderite decreased the availability of the phosphoric acid in rock phosphate and decidedly increased that of vivianite. When measured by four crops the phosphoric acid in phytin was about as available as that of acid phosphate. The phosphoric acid in the aqueous extract of cottonseed meal was much less available than that in crude phytin. A considerable variation in the availability of the phosphoric acid of basic slag in different soils was observed. It averaged about 65 per cent as available as that of acid phosphate.

Thirty years' experience with sulphate of ammonia, F. W. MOESE (*Massachusetts Sta. Bul. 204 (1921), pp. 83-98, pls. 2*).—The results of experiments begun in 1889 on sandy loam soil with different crops in which ammonium sulphate was used as a source of nitrogen year after year in a single arbitrary quantity are reported. The amount of fertilizer nitrogen applied as ammonium sulphate was not dictated by the value of the crops to be grown.

It was found that ammonium sulphate was effective as a fertilizer when accompanied by an application of lime. In the absence of lime it was sometimes injurious, due to the formation of soluble compounds of manganese, aluminum, and iron. Injury was greatest during dry periods, when the lessened soil moisture became more saturated with soluble salts. Ammonium sulphate was particularly effective on the cereals, corn, oats, rye, and millet, when these crops did not follow a clover crop. Potatoes were not benefited by ammonium sulphate. Soy beans when uninoculated responded well, but this effect decreased as the root nodules increased in the later years. Clover was not much benefited by ammonium sulphate, but mixed grasses in 1920 were much increased by it. In general ammonium sulphate was found to be about nine-tenths as effective as sodium nitrate per unit of nitrogen.

Results of field studies in cane culture in Java.—Studies with furnace ashes, molasses cinder, molascuit, molastego, and molastella up to 1918, J. KUYPER (*Arch. Suikerindus, Nederland, Indis, 29 (1921), No. 19, pp. 591-654, figs. 6; abs. in Chem. Abs. 15 (1921), No. 18, p. 3173*).—The results of 185 different experiments, including 220 observations on the fertilizing value of ashes from sugar refinery furnaces on cane, are reported in considerable detail.

Marked increases in yield resulting from the use of furnace ashes were noted in only a few instances, but small increases were observed in many cases. They seemed to be best adapted for use on certain soil types, and gave the best results on heavy soils deficient in phosphoric acid. The ashes are therefore considered to act mainly as a phosphatic fertilizer and a mechanical ameliorant. In certain cases, however, they gave good results on light soils well supplied with phosphoric acid. They had no influence on Java soils as a potassic fertilizer. They increased the amount of the cane crop principally, although in most cases they increased the sugar yield to some extent.

Molasses cinder consists of a mixture of 100 parts of molasses, 250 parts of ashes, 100 parts of filter press cake, 60 parts of stable manure, and 30 parts of bagasse meal. Thirty-five different tests with this mixture showed it to have little fertilizing value, and injury was noted in a few cases.

Molascuit and molastego are mixtures of molasses with bagasse meal, the former containing 80 per cent and the latter 72 per cent of molasses. Molas-

tella is a mixture of molasses and cassava residues. The very slight increases in yield obtained by use of these mixtures in certain cases is attributed to their molasses content, and it is thought that the high content of cellulose in the molastella may be injurious.

The recovery of potash as a by-product in the blast-furnace industry, W. H. ROSS and A. R. MERZ (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 302, 303).—In a contribution from the U. S. Department of Agriculture, the results of a study are presented which showed that the weighted average of the potash in the ores, coke, and limestone used in the blast-furnace industry amounts to approximately 0.2 per cent for each material, which is less than one-third as great as that found for the raw mix used in the cement industry. In the case of the ores the potash ranges from 0.05 per cent for Mesaba ores to over 2 per cent for certain foreign ores. As the consumption of high potash ores is relatively small as compared with low potash ores, the weighted average of the potash in the ores consumed is less than the mean average found for different ore samples. On the basis of weighted averages the total potash in the ore, coke, and limestone used in blast furnaces amounts, respectively, to 7.2, 1.9, and 4.9 lbs. per ton of pig iron, or to a total of 14 lbs. The potash in the slag amounts to 8.4 lbs., which leaves a balance for the potash volatilized of 5.6 lbs. per ton of pig iron. This amounts to a total for all plants of about 100,000 tons annually as compared with 87,000 tons for the cement industry. As there are twice as many blast furnaces as cement plants in the United States, the quantity of potash lost per individual plant must be less in the blast furnace than in the cement industry, but it is possible that the dust from some blast furnaces in which manganiferous or southern ores are used may be richer than the richest cement dust.

Studies of sulphur oxidation in sulphur-floats-soil mixtures, J. S. JOFFE (*Soil Sci.*, 13 (1922), No. 2, pp. 107-118, figs. 2).—Studies conducted at the New Jersey Experiment Stations on the effect of aeration and initial reaction on the oxidation of sulphur in sulphur-floats-soil mixtures are reported.

In the aeration studies it was found that more citrate-soluble phosphorus was formed in aerated mixtures than in nonaerated mixtures until the pH of the nonaerated mixtures reached the value 2.8, after which the nonaerated mixtures produced soluble phosphates as fast as the aerated mixtures. This result is taken to indicate that aeration ceased to be a factor in the mechanism of sulphur oxidation after the mixtures reached a pH value of 2.8.

In the initial reaction studies it was found that small additions of sulphuric acid have a beneficial influence on the process of sulphur oxidation in sulphur-floats-soil composts. Greater amounts of sulphuric acid seemed not only to kill most of the microbial flora but even to shock the strongest sulphur oxidizers. It is considered probable that the addition of small amounts of acid eliminated undesirable competitors from the field and gave free range to the sulphur oxidizers, but beyond that point caused harm. The results are taken to indicate, however, that the addition of small amounts of acid seemed to benefit sulphur oxidation.

A study of the course of conversion of insoluble phosphates into soluble phosphates in sulphur-floats-soil mixtures is also reported. The results are taken to indicate that the crucial reaction for the conversion of the insoluble phosphates into soluble phosphates is that obtaining in a hydrogen-ion concentration corresponding to a pH value of 2.7. It is considered apparent that at this point the primary phosphate is formed which reacts with the tertiary, forming secondary, and in combination with the sulphuric acid constantly being formed in the cultures, completes the reaction.

Preliminary studies on the isolation of sulphur-oxidizing bacteria from sulphur-floats-soil composts, J. S. JOFFE (*Soil Sci.*, 13 (1922), No. 3, pp. 161-172).—In a contribution from the New Jersey Experiment Stations the more important studies of the sulphur cycle from a biological standpoint, with particular reference to sulphur oxidation in soils, are briefly reviewed, and preliminary studies of the process of sulphur oxidation and the reactions involved are reported which included the isolation of the organisms and an investigation of their morphological and physiological characteristics. The presence of a specific organism, which in 150 days oxidized nearly 50 per cent of the sulphur used, was demonstrated and its purity apparently proved. The associative action of fungi and bacteria in the oxidation of sulphur in soils is also discussed.

Sulphur oxidation in "black alkali" soils, W. RUDOLFS (*Soil Sci.*, 13 (1922), No. 3, pp. 215-229, fig. 1).—Studies conducted at the New Jersey Experiment Stations on the influence of inoculated sulphur on soil containing an excess of black alkali are reported.

Soil to which inoculated sulphur was added seemed to assume, through the formation of sulphates, a new set of physical properties characterized by a more complete flocculation and changes in water-holding power and apparent specific gravity.

In "black alkali" soils small amounts of sulphur exerted little or no influence upon the hydrogen-ion concentration, but larger quantities brought about a decided change. The changes were similar in cultures kept in an incubator at 28° C. and at an optimum moisture content and in cultures kept in glazed earthenware pots in the greenhouse which were watered at indefinite intervals.

Leached soil was more readily neutralized by the addition of inoculated sulphur than unleached soil, as indicated by titration and hydrogen-ion concentration methods. After 18 weeks the added sulphur had been practically oxidized in all cultures. Carbonates were transformed into bicarbonates with the increase in sulphur oxidation. Although high alkalinity was changed into less alkalinity, high salt contents remained, since no leaching occurred. There was a striking relation between the sulphate formation and the flocculation, turbidity, and apparent specific gravity of the leached and unleached soils. Sulphate formation tended to cause aggregation of the black alkali and Hanford sandy loam soils used, and the water-holding power seemed to be changed.

The biological flora expressed in numbers of colonies grown on agar plates varied directly with the change in hydrogen-ion concentration. The cultures with the unleached soil, which received sufficient amounts of inoculated sulphur to neutralize the alkalinity, produced after 12 weeks of incubation five times as many colonies per plate as did the untreated cultures, and the treated cultures of the leached soil from three to five times as many colonies as did the untreated cultures. After 18 weeks these cultures in both soils produced approximately ten times as many colonies as did the untreated cultures.

The biological flora changed with the increase of the hydrogen-ion concentration. In the leached soil cultures, which reached or approached the neutral point after sulphur application, there were but relatively few colonies of molds and Actinomycetes, whereas the colonies counted on agar plates made from infusions of untreated soil consisted largely or nearly entirely of molds and Actinomycetes. Barley seeds germinated and grew readily in alkali soil treated with inoculated sulphur, but the plantlets were always killed by the salt incrustations on top of the soil which dissolved when the pots were watered, while the water penetrated the soil but slowly on account of its poor physical condition.

The effect of alum on silicate colloids, C. S. SCOFIELD (*Jour. Wash. Acad. Sci.*, 11 (1921), No. 18, pp. 438, 439).—In a contribution from the U. S. Department of Agriculture, it is stated that laboratory and field studies have shown that aluminum sulphate is very effective in unimproving the physical condition of certain irrigated soils that are relatively impermeable to water and that become very hard on drying. This salt is readily soluble and in solution reacts directly with sodium silicate, forming an insoluble aluminum silicate and leaving in the soil solution the resulting sodium sulphate which may be removed easily by leaching.

"Aluminum sulphate may be used freely on alkaline irrigated land without injury to succeeding crops. In fact an examination of the leachings from soils to which liberal applications of aluminum sulphate have been made shows that practically all the aluminum is precipitated in the soil, and that corresponding quantities of sodium, calcium, and magnesium are released into the soil solution combined with the sulphate radicle."

Inspection of commercial fertilizers for the season of 1921, H. D. HASKINS, L. S. WALKER, and R. W. SWIFT (*Massachusetts Sta. Control Ser. Bul.* 16 (1921), pp. 5-39).—This bulletin presents a summary of the results of analyses of 1,504 samples of fertilizers and fertilizer materials, representing 536 distinct brands, collected for inspection in Massachusetts during 1921, together with guarantees and general information on inspection and its results.

Inspection of lime products used in agriculture for the season of 1921, H. D. HASKINS, L. S. WALKER, and R. W. SWIFT (*Massachusetts Sta. Control Ser. Bul.* 17 (1921), pp. 3-8, fig. 1).—Results of analyses, with guarantees and valuations, of samples of 26 brands of caustic, hydrated, precipitated, and air-slaked limes, lime ashes, ground raw limestone, and ground shell lime collected for inspection in Massachusetts during 1921 are presented, together with data on the importance of the degree of fineness of ground limestone.

Fertilizer registrations for 1922, C. S. CATHCART (*New Jersey Stat. Bul.* 364 (1922), pp. 5-29).—A list of brands of fertilizers and fertilizer materials registered for sale in New Jersey for the fiscal year ending October 31, 1922, is presented.

AGRICULTURAL BOTANY.

Contributions on plant breeding, J. BROILL (*Deut. Landw. Presse*, 47 (1920), Nos. 64, pp. 447, 448, figs. 2; 75, pp. 513, 514; 48 (1921), Nos. 17, p. 121; 30, p. 230; 41, p. 312; 45, pp. 341, 342).—The several sections of this series deal, respectively, with pollinizing tools and technique; potato breeding; the question of ringing the stems; studies with varieties having few seeds; and discussion of results.

Genetic segregation, W. BATESON (*Rou. Soc. [London], Proc., Ser. B*, 91 (1920), No. B 641, pp. 358-368).—It is considered clear from the evidence here given that in a wide view of living things segregation can not be exclusively a property of the reduction division, and that for the present it should be regarded as a possibility which may occur in any division in the life cycle.

Floral asymmetry, P. VUILLEMIN (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 1, pp. 35-38).—Aberrations from floral symmetry are discussed as to their frequency of occurrence, causation, and significance.

Studies of the pollen tubes and abortive ovules of the Globe mutant of *Datura*, J. T. BUCHHOLZ and A. F. BLAKESLEE (*Science, n. ser.*, 55 (1922), No. 1431, pp. 597-599, fig. 1).—In a previous publication (*E. S. R.*, 44, p. 327), a description was given of a number of mutants of *Datura* which are said to owe their mutant character to the presence of a single extra chromosome. Studies

of pollen grains and ovules are reported to explain the inheritance in these mutants, which is almost exclusively through the ovules, the Globe character being transmitted to only about one-fourth of the offspring. The authors report finding differences in the rate of pollen tube development, and it is inferred that the pollen tubes with the extra chromosome number develop more slowly than the others and thus fail to fertilize the ovule.

Algaroba seed germination tests, C. S. JUDD (*Hawaii. Forester and Agr.*, 17 (1920), No. 12, pp. 342-344).—Seed of *Prosopis juliflora* were tested to ascertain any hastening or lowering of germination due to passing through the intestinal tract of a horse.

It was found that algaroba seed is prepared for quick germination in the intestinal tract only when the tough parchment-like covering has previously been removed. This covering greatly hinders germination. Placing the naked seed in boiling water and soaking for 24 hours greatly hastens germination without injury. The best germination was given by the naked untreated seed.

The action of chloropicrin on the germinative power of seed, E. MÏÈGE (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 3, pp. 170-173; *abs. in Agr. (Hav. Canada)*, 9 (1922), No. 3, pp. 254, 255).—It is found that chloropicrin exerts an influence on the germinability of seeds which varies considerably according to the kinds tested, the dosage employed, and the duration of the treatment. Legumes, flax, etc., are little if at all affected, though germination is considerably reduced in beet and more so in the cereals. The impairment may amount to 30 per cent or more in case of wheat. See also a previous note (E. S. R., 45, p. 537).

Recent work on soil acidity and plant distribution, E. T. WHERRY (*Science*, n. ser., 55 (1922), No. 1430, pp. 568-570).—A review is given of some recent ecological publications, and the author claims that soil acidity is of fundamental importance in controlling the distribution of native plants.

Determination of acid and sugar in aqueous extract from wheat varieties and of resistance to rust, A. BYGDEËN (*A. Landtbr. Akad. Handl. och Tidskr.*, 58 (1919), No. 7-8, pp. 418-423; also in *Meddel. Centralanst. Fors  kar Jordbruksomr  det*, No. 192 (1919), pp. 20-25).—Tabular data are given for six to eight wheat varieties.

Forces concerned in the enlargement of cells during growth: A new artificial cell, D. T. MACDOUGAL (*Abs. in Science*, n. ser., 55 (1922), No. 1429, p. 546).—According to the author's conception, the protoplast in its earlier stages is a solid cylindrical or globoid mass of jellies. Enlargement or growth in this stage is by the addition of new material and its swelling by the imbibition of water. This is said to constitute growth by accretion. The growth by distension is the result of a formation of cavities or vacuoles in the protoplasm which are filled with substances that attract water and set up osmosis which causes a stretching or enlargement of the entire mass. The protoplasmic mass is described as including all substances in the cell which may take the form of a reversible gel, that is, which liquefies or dissolves in water or by heat and which solidifies at low temperatures or on dehydration.

Cytology of *Tilletia tritici*, J. F. DASTUR (*Ann. Bot. [London]*, 35 (1921), No. 139, pp. 399-407, pl. 1, figs. 9).—Results are given in considerable detail of the study of *T. tritici*.

Observations on some physical properties of protoplasm by aid of microdissection, W. SEIFRIZ (*Ann. Bot. [London]*, 35 (1921), No. 138, pp. 269-296, fig. 1).—Protoplasm subjected to dissection in water is generally found to be immiscible therein. When miscibility does occur, it is due to extreme liquidity or disorganization. Immiscibility is due possibly to the characteristic colloidal nature of the living substance, which may be merely colloidal structure,

although chemical constitution may be also a controlling factor. The absorption and retention of water by protoplasm is thought to be essentially a process of imbibition.

A contribution to the study of water-conductivity in sycamore wood, M. G. HOLMES (*Ann. Bot. [London]*, 35 (1921), No. 138, pp. 251-268, figs. 13).—In this paper are described the results of an investigation into the constitution of the wood of young sycamore plants, with special reference to its efficiency for the conduction of water, the work being a continuation of that begun on stool shoots of hazel (*E. S. R.*, 41, p. 328) and ash (*E. S. R.*, 43, p. 31), though observations in the present case are not confined to first-year wood. Opportunity is taken to correct a mistake which appears in some of the figures given in earlier papers. With regard to the wood of the second and outer annual rings, it is pointed out that there is less variation in the specific conductivity for water than in the first year wood; the vessels are wider but less abundant, and this tends to lower somewhat the figures for specific conductivity. In general, the specific conductivity in the wood of young sycamore plants, estimated in its transverse aspect, is near that found for hazel stool shoots and higher than that for ash.

On certain plastids, with special reference to the protein bodies of *Zea*, *Ricinus*, and *Conopholis*, D. M. MOTTIER (*Ann. Bot. [London]*, 35 (1921), No. 139, pp. 349-364, pl. 1).—In addition to leucoplasts and chloroplasts, protein and probably oil bodies owe their origin to plastids whose primordia are permanent organs of the cell, existing in the cytoplasm as densely staining rods or granules.

In *Z. mays* the primordia of the protein plastids are chiefly small rounded bodies distributed in the cytoplasm. These increase in size, becoming relatively large and very numerous, especially in the outermost layers of endosperm, the aleurone layer. Small protein granules arising in the same manner occur also in cells beneath the aleurone layer. These seem to be more numerous in sweet corn.

The protein granules in *Ricinus* arise also from preexisting granular or rod-shaped primordia. They aggregate in large numbers in vacuole-like cavities, and their combined products unite in these cavities to form the large aleurone grains of the mature seed. As the seed matures, at least a part of the protein forms the crystalloids near which the globoid arises. Nothing was found to indicate that a globoid was a center for the formation of the aleurone granule as claimed by Pfeffer.

The protein bodies in the parasite *Conopholis* arise from primordia in the same manner as in the endosperm of *Zea*. It is considered possible that the oil in the seeds of *Ricinus* owes its origin to oil plastids, being the synthetic product of such plastids.

Hemicellulose of apple wood, W. E. TOTTINGHAM, R. H. ROBERTS, and S. LERKOVSKY (*Jour. Biol. Chem.*, 45 (1921), No. 3, pp. 407-414, fig. 1).—This paper covers the preliminary chemical phase of an investigation upon conditions of composition associated with fruitfulness in apple and other fruit trees. It deals with the composition of apple spurs and adjacent wood, with special reference to the hemicellulose fraction.

Analysis of apple wood from fruiting branches showed a high content of the acid-hydrolyzable material commonly designated as hemicellulose. The alcohol-soluble fraction resulting from partial hydrolysis of this material has been found to contain large amounts of xylose and glucose, with a little galactose. It is suggested that this hydrolyzable material forms a reserve source of carbohydrate in the metabolism of the apple tree.

The function of calcium in the nutrition of seedlings, R. H. TRUE (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 3, pp. 91-107).—This work deals with seedlings of various crop plants grown in water cultures mainly kept in darkness. The methods employed have been discussed previously (E. S. R., 34, p. 224). Other work more or less related has been noted (E. S. R., 33, p. 628; 41, p. 221).

From the results as here tabulated and discussed, the author concludes that pure water represents a partial ionic vacuum to roots of plants and tends to establish an equilibrium with the cell contents by the withdrawal of ions from the plant. This leads in some plants and animals to deep seated changes and to consequent injury. This injurious action is not fully overcome by any one pair of ions (salt) tested, but is very largely overcome by salts yielding the Ca^{++} ion, to a very much less degree by those yielding the Mg^{++} ion, and but very slightly or not at all by those carrying the K^{+} or Na^{+} ion.

The Ca salts most abundantly absorbed are CaCl_2 , CaCO_3 , and $\text{Ca}(\text{NO}_3)_2$. CaSO_4 also is absorbed in an approximately like degree by plants that are at home on sandy and acid lands, such as alsike clover, white lupine, and peanut. For hearty feeders that require rich soil and a higher lime content, the absorption from CaSO_4 solutions is much less than from solutions of the other Ca salts named. This difference is probably to be attributed to the influence of the anion.

The absorption of electrolytes is increased by the increase in the number of kinds of nutrient ions present in the solution. Further conclusions are detailed.

The prospect regarding carbon dioxid fertilization, F. RIEDEL (*Chem. Ztg.*, 45 (1921), No. 20, pp. 157, 158).—A review is given of published accounts following the author's reports of studies (E. S. R., 42, pp. 723, 816) on the use of carbon dioxid as a fertilizer.

[The effect of carbon dioxid on plants], F. RIEDEL (*Chem. Ztg.*, 45 (1921), No. 104, pp. 829, 830).—Discussion continuing that above noted deals mainly with the practical aspects of carbon dioxid fertilization.

The chemical mechanism of assimilation by green plants, P. MAZÉ (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 3, pp. 173-175).—Further details are given on phases of this inquiry (E. S. R., 47, p. 128).

The stabilization of characters in plants grown in salt water, P. LESAGE (*Compt. Rend. Acad. Sci. [Paris]*, 168 (1919), No. 20, pp. 1003-1005, fig. 1).—Pursuant to the account previously noted (E. S. R., 35, p. 228), the author discusses briefly the gradual development during eight generations of characters in *Lepidium sativum* (short, plump, rounded seeds) regarded as new and stable, and resulting from environmental factors.

Anomalies in plants grown in salt water, P. LESAGE (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 1, pp. 82-84).—In 1920, anomalies, in seed shapes, which are described, appeared in the plants (*Lepidium sativum*) employed in the studies noted above and previously.

Studies in the energy relations of plants.—I, **The increase in area of leaves and leaf surface of Cucumis sativus**, F. G. GREGORY (*Ann. Bot. [London]*, 35 (1921), No. 137, pp. 93-123, figs. 15).—A method is described for ascertaining the area of the leaves of *C. sativus* without detaching them from the plant. The errors of the method are discussed, and it is shown that a single determination of the total area of the leaf surface is significant to 5 per cent.

The growth in length, breadth, and area of leaves in daylight is claimed to follow the same law as the growth in length of axial organs, displaying a grand period of growth. Under continuous electric illumination, however, the rate of increase falls off from the first measurement of area onward. The curves

of increase in area and in linear dimensions for a single leaf in daylight are of **S** form, and can be fairly represented by the formula of an autocatalytic reaction in which the material catalyzed gradually decreases in amount as the reaction proceeds. A modification of this formula is introduced to represent the growth in area of single leaves under artificial light.

The increase in area of the total leaf surface of plants grown in daylight in March and June closely follows a compound-interest law, the rate of increase at any time being proportional to the area existing at that time. For plants grown in December, however, the increase of total leaf area follows a more complex law, which is indicated. Plants grown under artificial light appear, as regards total leaf area, to follow the same law as that for plants grown in full daylight in December, and show also the action of a detrimental time factor, which may be due to high temperature.

It is shown that under comparable conditions the average leaf area is determined by the product of intensity and duration of light radiation.

In support of the compound-interest law of leaf surface growth, coefficients are quoted for correlations between maximum area of cotyledons and maximum area of first leaf, between maximum area of cotyledons and dry weight of plant after 30 days, and between growth rate and crop weight.

Photoperiodism, the response of the plant to relative length of day and night. W. W. GARNER and H. A. ALLARD (*Science*, n. ser., 55 (1922), No. 1431, pp. 582, 583).—In a previous publication (*E. S. R.*, 42, p. 818), the authors showed that the length of day exercised a remarkable regulatory action in initiating or inhibiting sexual reproduction in plants. Subsequent to this publication investigations have been extended to cover other features of plant activity as affected by the prevailing length of day.

Preliminary to a full publication of the details of the investigation, the authors claim that the duration of the daily illumination period not only influences the quantity of photosynthetic material formed, but also may determine the use which the plant can make of such material. In general, there is said to be an optimal light period for maximum upward or apogeotropic elongation of the stem, which for some species corresponds to the long summer days of higher latitudes, while for others the intermediate length of day, or the equatorial length of day, is optimal. Changes in the light period to sub-optimum conditions for stem elongation may initiate a series of characteristic responses which are associated with periodicity in plant behavior.

There is said to be apparently an optimal light period for sex reproduction which tends to direct the energies of the plant more or less quantitatively toward flowering and fruiting. A departure in length of day from the optimal for increase in stature is said to cause loss of dominance of the apical bud, thus promoting various types of branching. Leaf fall and entrance upon the rest period, also, are said to result from exposure to a certain length of day which is unfavorable for stem growth. Changes of the light period away from the optimal for increase in stature and beyond the optimal for sexual reproduction was found to induce intense tuberization. The formation of bulbs was induced by excessively long days, while the formation of tubers commonly resulted from excessively short days. This deposition of carbohydrate in relatively condensed or dehydrated forms as a result of an unfavorable light period is taken to indicate marked loss of power to utilize the products of photosynthesis in elongating the stem or developing flower and fruit, a condition which well exemplified the stemless or leaf-rosette form of foliage development.

The authors claim that the evidence indicates that the degree of hydration of the living cell content is brought under delicate control by the ratio of the

number of hours of sunlight to the number of hours of darkness in the 24-hour period, and a well-defined correlation has been established between the hydrogen-ion concentration of the cell sap and the observed responses of the plant to change in the length of day. It is considered probable that the annual cycle of length of day, affording as it does a consistently rhythmic feature of the external environment, is a dominant causal factor in phenomena of plant periodicity, subject to the modifying influences of temperature and other environmental factors.

Some aspects of the use of annual rings of trees in climatic study, A. E. DOUGLASS (*Abs. in Science, n. ser., 55 (1922), No. 1429, p. 548*).—From a study of the annual rings in 450 trees, the author claims that growth of dry climate trees depends on the topography which controls their water supply. In dry climates the trees show variations which match the rainfall with remarkable exactness. In certain wet climates they show variation that corresponds to the solar activity, which is denoted by the number of sunspots which occur in cycles of 11 years.

The life history of a pine tree as read from a longitudinally bisected trunk, F. SUREVE (*Abs. in Science, n. ser., 55 (1922), No. 1429, p. 548*).—A study was made of a median longitudinal section of the trunk of a tree of *Pinus radiata* 38 years old. Cross sections of the trunk at different heights are said to indicate that in *P. radiata* a true measure of the annual growth performances should be based on several cross sections at different heights and not on data from the stump section alone.

FIELD CROPS.

Preliminary investigations with herbage plants, R. G. STAPLEDON, R. D. WILLIAMS, T. J. JENKIN, and K. SAMPSON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. II, No. 1 (1919-21), pp. 97*).—A report is given of three years' preliminary work with herbage plants at the Welsh Plant Breeding Station at Aberystwyth, embracing investigations of cultural methods, influence of drought, fungus diseases, the fertilization of grasses and clovers, and seasonal productivity; potentiality and nationality trials of exotic and indigenous grasses and legumes; and seed production studies. Part of this work has been noted already (*Id. S. R.*, 46, p. 727). The observations to date may be summarized as follows:

Frequent cutting or very heavy grazing throughout the growing season would tend to reduce the leafage of the plants to a point below which it would be impossible to elaborate sufficient nutriment to maintain healthy and fully developed growth from season to season. During one season a plant will have developed a certain extent of root range and a certain capital of nutriment which will presumably limit the productivity possible in a subsequent season. When given favorable conditions productivity will be reached up to that limit, and the plant will be able to produce herbage up to this point whether taken as hay or grazed, or as both. A rational management should consist of a well-thought-out scheme of rotational and intermediate grazing, aiming at conserving the energy of the plants by both preventing seed formation and permitting adequate periods of unhampered foliage development.

Source of origin as such is apparently not of paramount importance, but more significant is the fact that the various nationalities contain very different proportions of the different strains making up a species. The importance of "constituent strain" has been shown in the case of wild white clover, cocksfoot, timothy, perennial rye grass, and red clover. The possibility of isolating a good strain from a nationality which is worthless in the aggregate, or of relatively poor productivity, is emphasized. The large number of strains and types found

among all herbage plants is brought out, and it is thought that the influence of so-called acclimatization on any heterogeneous lot grown for several generations in a particular district would be merely to kill off those strains not well suited to the locality. Results with cocksfoot indicate that the ideal hay plant is not likely to prove also the ideal pasture plant, suggesting that with herbage plants, as with animals and cereals, reliance must be placed on special purpose strains. The best grazing strains of grasses will be found from among the indigenous plants.

The nationality trials demonstrated the inferiority of foreign red clovers in comparison with British and the unsatisfactory nature of French cocksfoot. The pooriness of Italian red clover and the risk of the introduction of anthracnose with its seed is emphasized. The merit of such old established British strains as the long persisting Montgomery clover, Cornish Marl, Dorset Marl, and certain late-flowering red clovers, together with the fact that individual British strains proved superior to foreign even in respect to stubble grazing in the seeding year, suggest the desirability of testing home-grown strains on an extensive scale.

Fodder crops for Australia, I. H. BRUNNING (*Melbourne: F. H. Brunning Pty., Ltd., 1922, pp. 128, figs. 44*).—Designed primarily for the Australian farmer, this booklet gives practical information on the culture and utilization of root crops, crucifers, annual summer fodders, clovers, grasses, and seed mixtures. Special treatment is accorded strawberry, subterranean, and Berseem clover, biennial and Hubam white sweet clovers, and Sudan grass, with the experiences of successful growers of these crops.

Bacteria for legumes, E. B. FRED and A. DAVENPORT (*Wis. Agr. Col. Ext. Circ. 143 (1922), pp. 23, figs. 17*)—A practical discussion of inoculation methods and benefits, with an extensive list of the wild legumes of Wisconsin.

Heating and spontaneous combustion of hay, H. MIENE (*Illus. Landw. Ztg., 42 (1922), Nos. 5-6, pp. 17, 18; 7-8, pp. 25, 26*).—A general discussion of the factors underlying the heating and spontaneous combustion of stored hay (E. S. R., 45, p. 127), with suggestions for farm and commercial practice.

[**Report of field crops work in Mississippi, 1920**], H. D. BROWN, J. F. O'KELLY, and G. B. WALKER (*Mississippi Sta. Rpt. 1921, pp. 18-20, 53*).—Varietal experiments with corn (E. S. R., 45, p. 128), cotton (E. S. R., 45, p. 130), and soy beans are described, and breeding work with these crops and legumes is noted briefly.

Tennessee Red Cob-72, Hastings, and Cokes Prolific led the corn varieties on early planted valley land, yielding from 53.8 to 56 bu. per acre; Station Tennessee Red Cob, Hastings, North Carolina Prolific, Pymaster, and Vardaman were ahead on hill land with yields from 17.8 to 18.7 bu.; and Laguna, Mexican June, and Goliad were first on late-planted valley land with from 30.7 to 40 bu.

Station strains of Foster were the leaders in production of seed cotton and in money value of lint and seed in the valley-land test, and Miller and Cleveland Big Boll made the best yields on hill land.

New cotton varieties developed at the Delta Substation include Express×Sunflower, a hybrid with 1½ in. staple and the earliness and fruiting habits of Express; and Foster Selection No. 6102, a 1½ in. cotton with many desirable qualities. The latter yielded 807 lbs. of lint per acre on 6.5 acres without fertilizer, notwithstanding a very bad cotton season. The results of extensive fertilizer experiments with cotton point to conclusions that the Delta soil of the Deer Creek silt loam type responds only to nitrogenous fertilizers, the best and cheapest forms of which are obtained through the growing of legumes.

The physiological value of smooth-awned barleys, H. K. HAYES and A. N. WILCOX (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 115-118).—It is suggested in this contribution from the Minnesota Experiment Station that before plant breeders and farmers decide to grow only awnless varieties they should consider that the awns of barley (E. S. R., 43, p. 826) and of wheat (E. S. R., 15, p. 247) have been shown to be important physiological organs, and that under various conditions bearded varieties have given higher yields (E. S. R., 41, p. 39) than awnless.

The use of smooth-awned strains of barley is expected, in a large measure, to overcome the unpleasant features of handling rough-awned varieties. Comparative yield tests (E. S. R., 41, 732), and studies in transpiration of heads of smooth- and rough-awned varieties at the station indicate that smooth-awned barleys have no physiological limitations when compared with standard rough-awned varieties.

The influence of atmospheric conditions upon the germination of Indian barley, W. YOUNGMAN (*India Dept. Agr. Mem., Bot. Ser.*, 11 (1921), No. 6, pp. 145-151, pls. 2).—After May in northeastern India, barley is regarded as subject to atmospheric conditions that affect its germination deleteriously, and unless extraordinary storage precautions be taken during the period of the monsoon the germination will be reduced by as much as 25 per cent. Meteorological conditions in June are intermediate between those of May and July, and July conditions represent somewhat those of August and September. Vapor pressures above 0.85 in. are rarely shown from October to April.

Samples of barley taken in June before the rains were subjected to vapor pressures ranging from 0.82 to 1.3 in. for periods of from 1 to 14 weeks at temperatures averaging about 30° C. (86° F.). The germination percentages indicated that a vapor pressure of 0.87 in. (0.0213 gm. water vapor per liter of air) may be taken as the safest maximum to which Indian barley intended for germination may be exposed. Exposure to this degree of humidity for 14 weeks had no deleterious effect, while exposure to a pressure of 0.89 in. for 11 to 14 weeks reduced the germination by approximately 25 per cent, and greater humidity than this totally destroyed germinating power in 14 weeks or less.

Cotton variety experiments, 1912-20, Substation No. 7, Spur, Tex., G. F. FREEMAN and R. E. DICKSON (*Texas Sta. Bul.* 288 (1922), pp. 3-17).—The annual results in comparative tests of varieties of cotton at the Spur Substation during the period indicated are tabulated and summarized. Even including three years of total failure due to lack of rain or hail, the average yield for the nine years amounted to 481 lbs. of seed cotton per acre, an average greater than for the State as a whole.

Cook yielded above the average in all years tested but is considered poor in storm resistance. F. G. 33, Round Nose, Chisholm, Boykin, and Truitt are also deemed worthy of mention. Lone Star made its best showings in bad years, its merit seeming to rise in proportion to the unfavorableness of the season. Snowflake and Durango produced the best results of the varieties averaging more than 1 in. in staple length. Mebane and Mebane Triumph, popular varieties in the section, showed consistent good yields in both favorable and unfavorable seasons, and unless the decided superiority of some other variety should be demonstrated in future tests, it would not be considered advisable to discontinue the planting of Mebane.

Cotton culture, J. B. GRIFFING (*Univ. Nanking, Agr. and Forestry Ser.*, 1 (1920), No. 3, pp. 13; *Chinese ed.*, pp. 12).—Cultural suggestions are given for the growing of American cotton in China.

Rogueing of cotton, J. B. GRIFFING (*Univ. Nanking, Agr. and Forestry Ser.*, 1 (1920), No. 2, pp. 8, pls. 6; *Chinese ed.*, pp. 10, pls. 6).—The causes of deteriora-

tion of cotton varieties and the value of eliminating off-type plants are discussed, with illustrations of desirable and undesirable variations in the Trice variety.

Testing the strength of cotton yarns, A. TESTER (*Cotton*, 86 (1922), No. 7, pp. 480-482, figs. 4).—A simple method for the accurate determination of the tensile strength of the warp.

The culture of henequen, R. DE ZAYAS ENRÍQUEZ (*Hacienda*, 16 (1921), Nos. 13, pp. 386-394, figs. 13; 14, pp. 428-433, figs. 8).—A concise account of henequen production in Yucatan and of the preparation of the fiber.

Peanut culture in Argentina, C. D. GIROLA (*Cultivo del Maní (Cacahuete) (Arachis hipogaea L.) en la República Argentina*. Buenos Aires: Gadola, 1921, pp. 108, pls. 2, figs. 42).—A general account discussing the distribution of the industry in Argentina, the soil and climatic adaptations of the peanut, and cultural practices and harvesting methods involved in its production, with notes on diseases, cost of operations, the utilization of the crop, and the machinery necessary in making oil, butter, meal, and other products. Detailed varietal descriptions are included, with a classification based on plant and fruit characters.

Varietal experiments with potatoes on different soil types, H. PIEPER (*Deut. Landw. Presse*, 48 (1921), No. 13, p. 87).—Twenty-six varieties were compared on a very mild, light, loamy sand and on a decidedly heavy loam. The highest yielders included Welsse Riesen with 587.4 bu. per acre, Geh.-Rat. Appel with 592 bu., and Weddigen with 577 bu. on the light soil, and 721, 546, and 550.3 bu., respectively, on the heavy soil. The starch content was higher on the heavy than on the light soil, but, in general, fewer tubers per plant were present. In order to recognize the true worth of varieties the author suggests that the varieties to be compared should be grown for a year under like conditions before putting them in comparative tests, in order that they might become adjusted and the influence of origin eliminated.

Fertilizing the potato crop: What is the best way to do it? D. G. COM (N. J. State Potato Assoc., *Hints to Potato Growers*, 2 (1922), No. 10, pp. 41, figs. 2).—In experiments by the New Jersey Experiment Stations, 13-48-13 chemical fertilizer at the rate of 600 lbs. per acre was applied in different positions in relation to the seed piece, resulting in the following acre yields: Fertilizer in direct contact with the seed piece, 132 bu.; mixed with the soil in the row, 152 bu.; above the seed with the soil separating, 128 bu.; at sides of seed and on the same plane, 173 bu.; at sides of seed but on lower plane, 206 bu.; and unfertilized, 64 bu.

Injury resulted in all the direct-contact rows, the seed piece either failing to germinate or the development of the plant being greatly retarded. The best results were obtained where the fertilizer was applied in the lower plane along the sides of the seed piece and separated by 1 or 2 in. of soil. Placing the fertilizer above the seed resulted in a low yield in dry weather because the roots were unable to reach it. In wet weather, however, the yield was better, since the fertilizer was leached down to the roots. These results point to the necessity of properly adjusting the fertilizer distributing attachments on the planter.

Potato growing in Iowa as affected by temperature, A. T. ERWIN and R. A. RUDNICK (*Iowa Sta. Bul.* 206 (1922), pp. 69-84, figs. 10).—In a series of plantings of potatoes commencing April 10 and every week thereafter, to and including June 12 during a six-year period, the April plantings averaged 124.4 bu. per acre and the June plantings 76.2 bu. A spread of 65.8 bu. was observed between the first and last plantings, with an average gain of 15.6 bu. per acre in favor of the earliest planting. Plantings included in the last week of April

and the first two weeks in May averaged about equal, while those made after May 15 showed a successive decline in yield.

The heaviest yields, on the average, were secured from plantings made shortly after the seasonal rise in temperature passes 40° F., a period usually reached during the first half of April in central Iowa. Since the minimum vegetative temperature for corn is fully 10° above that for potatoes, the general practice of planting late potatoes after corn planting is considered contrary to the temperature requirements of the two crops and is regarded as one of the important reasons for the decline of potato yields in the State. Besides facilitating the profitable early marketing, early planting may largely eliminate the danger from frost injury at harvest time.

A plat mulched with settled straw to a depth of 6 in. when the potatoes were completely up averaged 4° lower in soil temperature than a clean cultivated plat, although the differences were much greater in a number of instances. The three-year average of the mulched plat amounted to 111.6 bu. with 12.5 per cent of culls, as compared with 90.2 bu. with 21.3 per cent of culls from the clean cultivated plat. The use of a straw mulch is favored from the standpoint of increased yields and a better grade of potatoes. The plan has its limitations as a commercial proposition, but may prove advantageous for small patches.

Potato growing in New Jersey, W. H. MARTIN (*New Jersey Stat. Circ. 140* (1922), pp. 31, figs. 12).—The potato acreage in New Jersey has increased from 41,600 acres in 1897 to 95,000 acres, or 61 per cent of the improved land, in 1921 and with a total farm value of \$12,816,000. The average yield in 1921 amounted to 95 bu. per acre. In 1919 the average acre yields ranged from 50 bu. in Bergen County to 168.4 bu. in Monmouth County, yields from 300 to 350 bu. being often obtained in the latter county.

Differences in yields between counties and between individual growers in the same county are deemed probably due to growing potatoes on soils not adapted to the crop, deficient soil moisture, improper land preparation, the fertilizer requirements of the crop on the particular soil not being considered, inadequate fertilizer and cultivation, poor seed, and lack of protection from insects and from diseases. The means whereby losses in the commercial crop from these causes may be reduced are discussed briefly in this circular.

Selective shifting of the gamete frequency in a hybrid population of rye, N. HERBERT-NILSSON (*Hereditas*, 2 (1921), No. 3, pp. 364-369).—A strain of Brattingsborg rye (E. S. R., 40, p. 529) characterized by the persistence of chlorophyll in the stem, leaves, and glumes, even when fairly ripe, was crossed with a normal type of Petkus rye, and in the F₂ the nonripening character was found recessive in the ratio of 3:1. When carried to the F₇, 1,313 normal to 24 of the green type were found, closely approximating the theoretical ratio of 48:1.

The continuation of these experiments showed that, through successive elimination of the recessives, the gametic proportions can be shifted and new segregation numbers induced. The segregation, however, which must follow the Mendelian law, agrees in the gametic distribution in the population equally as clearly and exactly as in the gametic distribution within a self-fertilized plant.

Productive methods for soy beans in Missouri, W. C. ETHERIDGE and C. A. HELM (*Missouri Sta. Bul. 195* (1922), pp. 32, figs. 13).—Approved methods for the production of soy beans for seed and hay, derived from the results of varietal and cultural investigations with the crop (E. S. R., 46, p. 326.) at the station and on outlying experimental fields are outlined, with descriptions and comparative yields of the varieties recommended for the several sections of the State.

An example of the resistance of Java seedling canes to frost, W. E. CROSS and S. DELASCIO (*Rev. Indus. y Agr. Tucumán*, 11 (1921), No. 7-8, pp. 103-105; also in *Internatl. Sugar Jour.*, 23 (1921), No. 276, pp. 678, 679).—A plot at Tucuman containing Java seedlings POJ 36, POJ 213, POJ 228, POJ 234, and Kavangire was subjected to minimum temperatures from 24.2 to 29.3° F. from July 9 to 16, 1918, inclusive. The leaves and buds of all cane at the station were entirely frozen, and the ordinary tropical varieties soon began to deteriorate because of the frost. Frequent analyses during October, November, and December showed that the Java varieties, even when killed by frost, are slower to suffer destructive fermentation than the more tropical varieties. Analyses of unfrozen canes left standing during the second year of growth showed that the canes suffered practically no loss in purity during the whole of the second year, but that a parallel diminution of Brix readings and sucrose (or increase in the water content) takes place during the rainy season, these values increasing again almost to their original amount when the dry season of late autumn and winter commences.

Shahjahanpur sugar cane No. 10, W. SAYER (*Agr. Jour. India*, 17 (1922), No. 1, pp. 94, 95).—Shahjahanpur No. 10, a variety of sugar cane from the Shahjahanpur Sugar Experiment Station in the United Provinces, India, was found to resist severe frosts remarkably well in Australia. Its good keeping qualities and sugar content led to a considerable distribution in southern Queensland. A recent analysis of the cane made at the Bundaberg, Queensland, Station gave the following results: Brix 21.7°, purity of juice 91 per cent, percentage of fiber in cane 13.6, and commercial cane sugar 15.95 per cent.

Burning of sugar-cane fields (*Sugar [New York]*, 24 (1922), No. 5, pp. 246-248, *figs. 3*).—Plots of first ratoons of H 109 were harvested immediately, 5, 10, and 15 days after burning, and corresponding areas of unburned canes were taken from the same blocks at the same times, in an experiment at the Ewa Plantation, Hawaii, reported by J. A. Verret.

Analyses showed that burned cane lost 50.23 per cent of its original sugar when the harvest was delayed 15 days after burning, or at the rate of 3.35 per cent per day. The total loss was 14.72 per cent during the first 5 days and 29.7 per cent in 10 days. The rate of deterioration showed a gradual increase with a prolongation of the time after burning. Burned cane cut at once and burned cane allowed to stand until milled differed little in the losses in sugar.

Burned cane allowed to stand lost a weight of cane amounting to 6.57 per cent at the end of 5 days, 11.39 per cent in 10 days, and 20.29 per cent in 15 days. When cut immediately after the fire, the loss in weight of cane in these periods amounted to 15.3, 22.45, and 19.18 per cent, respectively. The rate of loss in the cut burned cane tended to diminish as the cane became drier.

The density of the juice of burned cane allowed to stand showed a tendency to decrease rather than to increase. On the contrary, a decided increase in the density of the juice (from 18.6 to 22.1° Brix in 15 days) was noted in the case of burned cane cut at once. The juices of burned cane, whether cut or standing, dropped in purity at about the same rate. The quality ratio (tons of cane per ton of sugar) of cut burned cane was better than that of standing burned cane, due entirely to the higher density of its juice.

Sweet clover, R. K. BONNETT and H. W. HULBERT (*Idaho Sta. Circ.* 22 (1922), pp. 14, *figs. 3*).—The habits of growth and adaptation of biennial sweet clover are described, and cultural and field practices are suggested for growing the crop for hay, seed, pasture, and silage; and as a nurse crop, as a soil improver, and in rotations.

In tests at the station and in other parts of the State, Hubam annual sweet clover did not produce as heavy a yield of forage as the first season's growth

of the biennial white, and the quality of the hay from the latter was also superior.

Hubam clover, F. S. WILKINS (*Iowa Sta. Circ. 76 (1922)*, pp. 16, figs. 6).—A summary account of experiments at the station, involving Hubam annual white sweet clover, with an outline of the history, distribution, and present status of the crop, comparisons with the biennial type, and recommendations for growing the seed crop.

Preliminary tests indicate that the crop will probably prove the best green manure to seed with small grain in the spring and plow down in the fall of the same year on soils well drained and not acid, and will prove to be a satisfactory emergency leguminous hay crop to seed when red clover or alfalfa fail. It will also make excellent summer and fall pasture for cattle and sheep.

Hubam clover has outgrown the biennial sweet clovers, red clovers, and other clovers at the station during the six-year period since its discovery by H. D. Hughes in 1916, and it outyielded these clovers in actual field tests in 1920 and 1921. Seeded following oats in 1921, Hubam produced 2.07 tons of air dry hay per acre, while biennial white sweet clover produced 1.85 tons, biennial yellow 1.56 tons, alfalfa 1.14 tons, medium red clover 0.95 ton, and Mammoth clover 0.92 ton. As an average of two years' results, Hubam returned approximately 1.5 times as much organic matter to the soil in stems and leaves as biennial white sweet clover in the first year of growth after small grain, and approximately 3 times as much organic matter as medium red clover.

It is indicated that Hubam clover should be seeded at about oat seeding time in the Northern States. When Hubam was broadcasted alone for hay in 1921, a 16-lb. rate of seeding per acre yielded most and was nearly free from weeds. Hubam clover, cut at ordinary mower height when beginning to bloom, yielded 2.28 tons of air dry hay per acre in a height and time-of-cutting test. Cuttings made when one-half of the plants were in bloom, and of plants in full bloom, yielded more, but the hay was coarser and less leafy, and the stand for the second growth on plats cut later was not nearly as good as for the earliest cutting. The clover cut close to the ground survived the unusually dry hot weather in July better than that cut 8 in. high. When Hubam clover at four different rates, 4, 8, 12, and 16 lbs. per acre, was sown with Iowar oats seeded at the rates of 1, 2, and 3 bu. per acre, differences in yield were not significant, but Hubam at the rate of 16 lbs. per acre with 1 bu. of oats produced a mixture with the highest percentage of Hubam.

Analyses indicate that Hubam and biennial white sweet clover have about the same composition when cut in similar stages of maturity and when grown under similar conditions.

The average yield of hulled, cleaned seed of all broadcasted plats of Hubam at the station in 1921 was 166.1 lbs. per acre as compared with 322.7 lbs. from all plats grown in rows. Hubam clover apparently can not be depended upon to mature a seed crop following small grain in the latitude of the station, but reports indicate that this method of seed production may be successful farther south.

Teosinte in Mexico, G. N. COLLINS (*Jour. Heredity*, 12 (1921), No. 8, pp. 339-350, figs. 8).—The author and J. H. Kempton found annual forms of teosinte growing wild in Durango and the State of Mexico, and a perennial form in Jalisco. Although occasionally cut for fodder, teosinte was nowhere cultivated, but on the other hand it was not found as a wild plant outside of cultivated areas. The natural habitat of all forms appears to be level, alluvial lands not subject to extreme drought, and none of the forms are common or widely dis-

tributed. Although teosinte and maize were growing in close proximity, little evidence of natural hybridization was noted.

A perennial form of teosinte differs from all previously known types, which are annuals, by the production of rhizomes. In its seed characters this form resembles the cultivated teosinte of Florida more closely than the annual varieties of Mexico. If all forms of teosinte are descended from a single stock, it is felt that of the known forms the perennial species most closely approximates this common ancestor.

[**Tobacco production in the Southern States**] (*Tobacco*, 73 (1922), No. 22, pp. 39-42, 43, 49-52, 53, 54, 64, 65, 66, 71, 99, 101, 122, 137, figs. 19).—Among the papers included in this number are the following: The Start and Progress of Tobacco Culture in Colonial Virginia, by P. F. Jones; What the North Carolina Experiment Station Is Doing for Tobacco Growers, by R. W. Green; History of the Burley Tobacco Growers' Cooperative Association, by J. S. Porter; Culture of Various Dark Tobaccos in Central Virginia District, by P. F. Jones; Culture and Methods of Handling Tobacco in the Flue-cured Belt, by E. G. Moss; Is There Profit in the Production of Bright Tobacco in Georgia? by E. C. Westbrook; Development of Bright Tobacco in Virginia and the Carolinas, by E. H. Mathewson; The Spread of the Bright Leaf Tobacco Belt and the Causes, by F. Parker; and History and Control of Tobacco Wildfire, by P. J. Anderson.

Certain relations between the protein content of wheat and the length of the growing period of the head-bearing stalks, W. F. GERICKE (*Soil Sci.*, 13 (1922), No. 2, pp. 135-138).—In a further discussion of an experiment noted earlier (*E. S. R.*, 44, p. 735), the author finds no correlation between the length of the growing period of the plants receiving different treatments and the protein content of the wheat. However, the cultures which received nitrogen 33 to 48 days after planting had the shortest growing period of all in the series, showing that applications of nitrogen to wheat plants, made at certain growth phases, can shorten the total length of the growing period, while applications of nitrogen made at other growth periods of the plant can lengthen its total growing period. It appears "that the most probable explanation of the cause of the differences in protein content of this wheat is to be found in the differences in the rates of absorption of nitrogen and its utilization, which were greater in the wheat whose head-bearing stalks had a short growing period than in those which had a long growing period."

The effect of nitrates applied at different stages of growth on the yield, composition, and quality of wheat, J. DAVIDSON (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 118-122).—In an experiment by the Bureau of Chemistry, U. S. D. A., the period between the resumption of growth of wheat in the spring and the time of heading was divided into three subperiods, and each of three corresponding sets of plats received nitrates at one of these subperiods. See also an earlier note (*E. S. R.*, 40, p. 244).

The results obtained indicate that the effectiveness of nitrates in increasing yields decreases consistently as the time of their application approaches the stage of heading. The effectiveness of nitrates in increasing the protein content ($N \times 5.7$) of the grain, however, increases as their effectiveness in augmenting the yield decreases.

The character of 1919 crop spring wheat dockage, C. H. BAILEY (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 3, pp. 88-93).—The Minnesota Experiment Station, in cooperation with the Minnesota State Grain Inspection Department, conducted an investigation of dockage in spring wheat during the crop year 1919-20.

An average of 1.57 per cent of wild oats was found in 400 wheat samples representing the average of receipts from the entire spring wheat district commercially tributary to Minneapolis. The samples also contained an average of 2.84 per cent of dirt and fine seeds, the latter consisting largely of green foxtail, yellow foxtail, wild mustard, hare's-ear mustard, and wild buckwheat. Wild oats averaged 3.71 per cent in 140 samples collected at 80 country points in Minnesota, and the same weed seeds predominated in the fine dockage as in the 400 samples first examined.

Inseparable seeds were found in varying percentages in the different sections of the State, half of the samples collected in the Minnesota River Valley containing wild vetch seed, while about one-third of the samples from the northern Red River Valley contained kinghead after cleaning. Neither kinghead nor wild vetch was found to an appreciable extent in samples from the southern Red River Valley.

State laws concerning the sale of seeds and legume inoculants, J. G. FISKE (*New Jersey Stat. Circ. 137 (1922), pp. 15, fig. 1*).—The text of the act of 1919, regulating the sale of legume inoculants in the State, is given and the requirements explained. The portion of the circular concerned with the seed law is a revision of Circular 59 (E. S. R., 35, p. 835).

Seed analyses, 1913 to 1921, L. H. PAMMEL and C. M. KING (*Iowa Sta. Bul. 203 (1921), pp. 27-43*).—The average results of purity and germination tests and data as to the occurrence of weed and other crop seeds are tabulated for 8,478 samples of commercial seed tested during the period 1913 to 1921, inclusive. The need is indicated for field inspection of crops grown for seed stock and for the examination of mill screenings to prevent the spread of harmful weeds.

The weed seed tests show that most of the red clover seed sold in the State comes from the Corn Belt. Common pigweed occurred in 15.1 per cent of clover samples, small ragweed in 29.6 per cent, green and yellow foxtails in 59.8 per cent, yellow and tall dock in 23.9 per cent, lamb's-quarters in 33.3 per cent, and crab grass in 20 per cent, all being common Iowa weeds. Weeds not common in Iowa clover fields, including night-flowering catchfly, chicory, Canada thistle, and field dodder, occurred in 19.3, 0.96, 1.5, and 2.4 per cent, respectively, of the samples and probably indicate sources other than the Corn Belt. No clover seed submitted evidenced a foreign source. A western source is generally indicated in the alfalfa seed tested by the presence of *Grindelia* (tarweed) and *Centaureas*. A general northern source for the alsike clover received and tested was demonstrated by the presence of Canada thistle and night-flowering catchfly.

[**Seed inspection in Virginia, 1920-21**], G. T. FRENCH (*Va. Dept. Agr. and Immigr., Ann. Rpt. Commr., 1921, pp. 47-66*).—Purity and germination determinations of 1,340 official samples of agricultural seed tested during the year ended September 30, 1921, are tabulated and discussed.

Weeds of California and methods of control (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 2-3, pp. XXII+74-360, figs. 125*).—This weed manual, designed for California conditions, embraces a key to the more important weeds of the State and the following papers: The Most Injurious Weeds, Weeds of Secondary Importance, and Miscellaneous Weeds, all by F. J. Smiley; Weeds and Their Habits, Weed Control Methods in Special Locations, and Impure Seeds, a Source of Weed Problem, all by E. Johnson; Suggestions for Controlling Weeds in California, by O. W. Newman and E. Johnson; Control of Noxious Weeds, by E. Johnson and O. W. Newman; Herbicides, by G. P. Gray; Rice Weeds, by P. B. Kennedy; Collecting and Preserving Plant Specimens, by O. W. Newman; and Laws Pertaining to Weed Control, by W. S. Wilkinson, jr.

A further note on the puncture vine (E. S. R., 44, p. 439) states that cultivation while young is the most effective and economical means of control. About two weeks after the first fall rains the seeds will be putting out tender roots, and the least disturbance at this period of growth will kill the seedlings. Since raking scatters large quantities of seed, it is suggested that the weeds in small patches be severed below the ground and when dry sprinkled with coal oil or distillate and burned.

The spraying of cornfield weeds with sulphate of ammonia, J. PORTER (*Jour. Min. Agr.* [London], 28 (1922), No. 12, pp. 1109-1116).—In comparative trials with herbicides in wheat fields in Herefordshire, a 3 per cent solution of copper sulphate had the usual burning effect on corn buttercup (*Ranunculus arvensis*), while a solution of nitrate of soda, 1 cwt. dissolved in water and made up to 60 gal., burned the buttercup leaves but slightly and soon advanced the growth of both the buttercups and the wheat. Two cwt. of sulphate of ammonia in water made up to 60 gal. was much more effective in checking the buttercup than a solution involving only 1 cwt. The yellowish color and stunted appearance of wheat sprayed with copper sulphate solution was very pronounced in comparison with the greener and taller plants on the sulphate and nitrate plots.

In experiments in Bucks, the solution of 2 cwt. sulphate of ammonia made up to 60 gal. destroyed charlock, wild white mustard, ivy leaf speedwell, and sheep sorrel; was partially effective on *R. arvensis*, *R. repens*, *R. acris*, dandelion, broad dock, and common field thistle; and was almost ineffective on black mustard, black bindweed, and sow thistle. At the rate of 11 lbs. to 3 gal. of water, sulphate of ammonia appeared capable of destroying a large proportion of the daisies present on lawns.

The 2 cwt. solution was much more effective in destroying wild white mustard in a field of spring oats than the weaker solution. Oats sprayed with the heavier solution produced 44 bu. per acre as compared with 36 bu. from the weaker solution and 32 bu. from those unsprayed.

HORTICULTURE.

Vegetable growing projects, R. L. WATTS (New York: Macmillan Co., 1922, pp. XXIII+318, figs. 80).—This handbook, designed primarily for the guidance of pupils in vocational agricultural schools, contains information of value to all classes of gardeners.

Practical plant propagation, A. C. HOTTES (New York: A. T. De La Mare Co., Inc., 1922 2. ed., enl., pp. 224, figs. 109).—An enlarged edition of a previously noted text (E. S. R., 38, p. 539).

[Horticultural progress report] (*Maryland Sta. Rpt. 1921, pp. VII-IX*).—Without presenting data, brief comments are given on the progress of miscellaneous investigations with various fruit, vegetable, and flower crops.

An old peach orchard in an unproductive condition was successfully restored to vigor and profitable bearing in a single season. A study of several different systems of grape pruning indicated that the three-wire Kniffin was most satisfactory for Maryland conditions. Disease resistant strains of tomatoes developed at the station and disseminated among practical growers have shown value. Lime when applied to various vegetables has proved of value, especially for sweet potatoes and spinach. Potash was found to be a lacking nutrient in many market garden soils throughout the State. Artificial light hastened the blooming of snapdragons and lupines in the station glasshouses.

The home vegetable garden as a business proposition, J. T. ROMA, JR. (*Missouri Sta. Bul. 193* (1922), pp. 16, figs. 6).—In the belief that the final

judgment on the value of home vegetable gardens must rest on actual economic considerations, irrespective of the many obvious advantages, such as abundant supply of fresh vegetables in their season, etc., accurate records were kept on two experimental gardens at Columbia, Mo., during the three years 1919-1921. One of the gardens, 80 by 135 ft., designated as the farm garden, was planned to accommodate a minimum of hand labor, while the other, the back-yard garden, embracing an area 30 by 75 ft., was planned on the assumption of an ample supply of hand labor. Both gardens were located on a soil of medium fertility which had been used for vegetable production for several years. Of the three years during which the project was maintained, 1920 was unfavorable as a whole, while 1919 and 1921 were quite satisfactory. The arrangements of the gardens are illustrated by diagrams contained in the text.

The farm garden was maintained during the 3-year period at an average cost of \$46.55 per acre, with gross returns averaging \$180.69, leaving a net balance per year of \$134.14. This garden returned \$1.76 for each hour of labor expended. The back-yard garden was operated at an average cost of \$18.64 per year, and yielded an average gross return of \$65.52, leaving a net balance of \$47.28. The labor return in this garden was at the rate of \$1.63 per hour.

Based on experiments, suggestions are made relative to the planting and management of small vegetable gardens, supplemented with tabulated data relative to varieties and planting dates for central Missouri.

Dusting vegetable crops in eastern Virginia, H. H. ZIMMERLEY, F. W. GEISE, and C. R. WILEY (*Virginia Truck Sta. Bul. 35-36 (1921), pp. 193-208, figs. 6*).—Laboratory and field studies conducted during the summer of 1921 for the purpose of obtaining information relative to effective methods of applying dusts to various truck crops and upon the comparative value of several insecticidal and fungicidal dusts are reported in this paper. It was found that in combating aphids with nicotine materials a small quantity of dust properly applied was much more effective than a larger quantity improperly used. Dust when drifting had practically no killing power, but when blown directly upon the insects was deadly in effect.

By replacement of the spreaders of a Niagara potato duster with short pieces of rubber hose so adjusted that the ends, held in place by a piece of iron pipe, touched the ground, the authors were able to effectively dust low-growing crops, such as spinach. A piece of light-weight canvas, 5 to 6 ft. in length, allowed to drag on the spinach in the rear of the outlets greatly increased the efficiency of the dusting operations. Adjustments found suitable to cantaloups, cucumbers, tomatoes, and other crops are described in the text.

The results of laboratory tests of the effect of various carriers on the killing power of nicotine dusts, reported in tabular form with discussions, indicated little difference in the value of the three materials tested, namely, kaolin, kieselguhr, and hydrated lime. The last-named material, being much the cheapest, is recommended from the viewpoint of economy. Three per cent nicotine dust used with hydrated lime as a carrier gave better control in the case of four different aphid species than did either 1 or 2 per cent mixtures. The 1, 2, and 3 per cent dust killed 72.2, 82.1, and 89.3 per cent, respectively.

Under field conditions, hydrated lime impregnated with 2 per cent nicotine and applied in quantities ranging from 20 to 40 lbs. per acre proved the most economical material for controlling two species of aphids on spinach. A dust containing at least 20 per cent of calcium arsenate is recommended for the control of the Colorado potato beetle. In comparing Noburn, a proprietary compound, with a 50 per cent calcium arsenate dust for the control of the cabbage looper and the imported cabbage worm, both materials were found to be equally effective; however, Noburn proved more rapid in action.

Suckering sweet corn unprofitable, H. C. THOMPSON (*Market Growers Jour.*, 30 (1922), No. 10, p. 16).—Three years' tests conducted at the New York Cornell Experiment Station on the effect of the removal of suckers on the yield, maturity, and size of the ears of sweet corn indicated that this practice, instead of being of value, materially reduced the yield in the case of the two varieties, Golden Bantam and Stowell Evergreen, used in the experiment. The deleterious effect of the operation was particularly noticeable when suckering was delayed until the corn was in tassel. No significant differences were observed in respect to time of maturity or the size of the ears. The author concludes that, under the conditions obtaining at Ithaca, N. Y., suckering of sweet corn is not a profitable practice.

Better methods of tomato production, J. T. ROSA, JR. (*Missouri Sta. Bul.* 194 (1922), pp. 24, figs. 9).—In addition to general information relative to improved methods of producing tomatoes, the results of investigations in Missouri and in other States are presented to emphasize the value of efficient cultural practices. General instructions are given for raising plants, selecting suitable soils, and for transplanting and cultural practices in the field.

That the selection of healthy, vigorous, productive plants as seed parents is a profitable practice was shown in a test at Columbia in which ordinary seedsmen's stocks were compared with seed of the same variety from plants selected in the field the previous season by commercial growers, an average gain in yield of 20.4 per cent being obtained for the six varieties tested. Based on a four years' test, the data of which are presented in tabular form, it was found that in most instances much larger yields were obtained from plants growing naturally on the ground than from those growing on stakes. Pruning also was found to reduce yield, and in respect to early fruits, staked and unstaked plants were practically equal.

Cooperative fertilizer tests conducted in various parts of Missouri in 1920-21 substantiated results of previous years (E. S. R., 45, p. 236). Phosphorus again proved to be the most generally lacking and important element of plant food, and nitrogen and potash used alone on comparatively fertile soils did not produce profitable increases in yield. The extraordinary value of phosphoric acid was shown by the fact that in one instance in 1921 a total investment of \$3.80 in this material yielded a net return of \$121. The relation of fertilizer to early maturity is indicated by a curve which shows that fertilized plants came into bearing three or four weeks earlier and reached the peak of production one week sooner than check plants. On relatively productive soils, where fertilizers showed little or no effect on yield, the fertilized plants matured their fruits earlier than the unfertilized. This stimulation of early production is believed to be correlated with early development of the plant rather than with any direct effect on fruit setting.

Results of a test of different methods of applying fertilizers indicated that drilling in the row, followed by thorough mixing with the soil previous to setting plants, is the most effective practice with small applications. The use of 1,000 lbs. of a 4-12-0 fertilizer per acre in 1920 on a productive soil type did not increase the yield above that produced by 500 lbs., whereas in 1921 on a poorer soil type the larger amount proved the more effective.

Improved methods of combating insect and fungus pests are discussed, with the recommendation that spraying is a profitable and in many cases a necessary practice.

The fundamentals of fruit production, V. R. GARDNER, F. C. BRADFORD, and H. D. HOOKER, JR. (*New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XVI+686, figs. 73*).—This text, as indicated by the title, deals with the

fundamental factors underlying successful fruit production. The subject is discussed under the general headings of water relations, nutrition, temperature relations, pruning, fruit setting, propagation, etc., and although intended primarily for the college student much information useful to the investigator and practical pomologist is contained herein. The thoroughness and broad scope of the work are indicated by the many summations of and references to pertinent work of other investigators in the fields of horticulture, plant physiology, chemistry, etc.

Stocks for fruit trees, M. DEUMIÉ (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 43 (1922), No. 17, pp. 398-403).—The urgent need of an efficient method of identifying root stocks upon which fruit trees are grafted is emphasized in this paper, in which the various stocks employed in the propagation of pears, apples, plums, peaches, etc., are discussed. It is stated that the highly important factor of soil adaptation of stocks has been ignored by nurserymen, who, as a rule, are more interested in the computability of stock with scion and in the habit of growth of the young tree. A table showing the soil preferences of various stocks and the effect of the stocks on the size, fruiting habit, and longevity of the scion is included.

Apple varieties which have made the best parents, R. WELLINGTON (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 28, 29).—Marked differences in the ability of parent apple varieties to transmit quality were observed in an analysis of the performance of apple seedlings of known parentage developed in plant breeding studies at the New York State Experiment Station. Data presented in a previously noted bulletin (E. S. R., 27, p. 843) are purposely omitted from this paper.

Among those varieties giving a high percentage of desirable progeny are Delicious and McIntosh, while Boiken, Grimes, Canada Baldwin, Jersey Blue, Wealthy, Deacon Jones, Montgomery, Yellow Transparent, and Red Canada are recorded among the unsuccessful parents. The number of good, mediocre, and poor seedlings resulting from 31 crosses is shown in tabular form.

Apples in north Mississippi, J. C. C. PRICK and C. T. AMES (*Mississippi Sta. Circ.* 41 (1921), pp. 4, figs. 2).—Emphasizing the fact that the soil and the climate of northern Mississippi are well adapted to apple growing, the authors briefly describes 12 worthy varieties, arranged in order of maturity, and supplement this information with brief cultural and spraying suggestions. It is stated that most varieties in this section bear annual crops, a fact which is believed to be due to the length of the growing season, which allows for both fruit and fruit bud formation.

Export of apples: Experiment in best maturity stage for shipment (*New Zeal. Jour. Agr.*, 24 (1922), No. 2, pp. 82-85).—With the object of ascertaining the best stage of maturity for picking apples destined for shipment in cold storage from New Zealand to England, fruit of the Cox Orange variety in five different stages of maturity, as determined by the percentage and quality of color, was picked on February 18 and 19, 1921. Examination upon arrival in London showed that none of the five lots were in good order on account of the prolonged voyage. However, those fruits representing the fourth stage of maturity, 25 per cent and upward of color on a light yellow ground, apparently were in the right stage at time of harvest. Of Dunn apples, representing four different stages in ripening, shipped from Wellington on April 15 and reaching London in good condition, those in the third stage of ripening, with 25 per cent and upward of bright attractive color, kept the best. In the case of Jonathan apples, representing seven different stages of maturity, lot No. 5, described as of bright good color on bright yellow ground, reached London

in the best marketable condition. The maturer lots, Nos. 6 and 7, reached their destination badly shriveled and in the case of No. 7 in a much decayed condition.

Harvesting and handling California cherries for eastern shipment, W. P. DURUZ (*California Sta. Circ. 232 (1922), pp. 19, figs. 18*).—In this circular relative to the best methods of picking, packing, and handling California cherries destined for eastern markets, based on information obtained in a survey conducted by the station during the season of 1921, particular stress is laid on proper construction and management of packing houses, types of containers, and cost of different materials and operations.

Undercooling of peach buds, E. S. JOHNSTON (*Amer. Jour. Bot., 9 (1922), No. 3, pp. 93-98, fig. 1*).—Thermoelectric determinations of the undercooling and freezing point of the sap of Elberta and Greensboro peach buds gathered at different intervals during the winter of 1920-21 indicated not only a gradual decrease in cold resistance with the approach of spring but also a difference in varieties in respect to resistance. Immediately preceding the opening of the buds on March 14 the undercooling point of Greensboro was 20.5° F. as compared with 22.3° for Elberta, while at the same time the freezing points were practically identical.

That wet buds freeze at a higher temperature than dry buds was shown in a comparative test with dipped and dry buds on March 14. The wet Elberta buds undercooled to 23.4 and froze at 29.5°, while the dry undercooled to 22.5 and froze at 25°. The wet Greensboro buds undercooled to 22.3 and froze at 29.3°, while dry buds undercooled to 19.9 and froze at 25.2°. A coating of lime sulphur had no appreciable effect on either the undercooling or freezing points of Greensboro buds.

The results of the experiment indicate that Greensboro is harder than Elberta at the time of bud opening, and that a period of cold weather immediately following a rain is more dangerous to fruit buds of the peach than that occurring during dry weather. Undercooling studies are believed by the author to be more reliable indices to frost resistance than are freezing point determinations.

Preparation of peaches for market, H. W. SAMSON (*U. S. Dept. Agr., Farmers' Bul. 1266 (1922), pp. 34, figs. 29*).—Information is presented relative to various factors concerned in the proper preparation of peaches for market, including means of determining the correct stage of maturity for picking, methods of picking, suitable facilities for transporting fruit from the orchard to the packing house, packages for shipment to packing houses, and improved methods of grading and packing the fruit. With the aid of diagrams and other illustrations, particular emphasis is placed upon the proper construction, interior arrangement and equipment of packing houses, featuring those of the southern peach belt, since these were found to be more highly standardized than those of the North. The necessity of greater care in harvesting, grading, and packing is urged on account of the extensive losses occurring each year due to neglect in these details.

Oil plants, Y. HENRY (*Plantes à Huile. Paris: Armand Colin, 1921, pp. 220, figs. 35*).—Various plants, including the peanut, cotton, sesame, castor-oil bean, hemp, coconut-oil palm, etc., are considered in respect to their distribution, production, and utilization as sources of vegetable oils.

Bulb gardening, M. HAMPDEN (*London: Thornton Butterworth Ltd., 1921, pp. 221, pls. 4, figs. 30*).—A popular text of English origin, illustrated partly in colors, discussing various species and varieties of bulbs and tuberous rooted

plants, with suggestions in regard to propagation, culture, and utilization. The subject is arranged in three sections, hardy, glasshouse, and half-hardy bulbs.

The flowering crabs, LADY MOORE (*Irish Gard.*, 17 (1922), No. 195, pp. 49, 50).—Various species of *Pyrus* useful for ornamental purposes are briefly described, with emphasis on the desirable characters of each.

FORESTRY.

Alaska's interior forests, J. D. GUTHRIE (*Jour. Forestry*, 20 (1922), No. 4, pp. 363-373).—Information contained in this paper is based on a month's trip through the interior of Alaska in the summer of 1920, supplemented by data obtained from various Government publications. Previous to this exploration there was little accurate data obtainable pertaining to the size, nature, and composition of the interior Alaskan forests.

Roughly estimated to include not less than 150,000,000 acres, these interior forests are confined for the most part to the basins of the Yukon and Kuskokwim Rivers and in certain places extend north of the Arctic Circle. In respect to species, density of stands, and size of trees, these interior forests are wholly unlike those of the coast. The principal species are white spruce, white birch, balsam, poplar, black cottonwood, aspen, black spruce, and larch, the first mentioned being by far the most important. White birch is also widely scattered and comprises a significant percentage of practically all stands, while the remaining species occur in favored sites, particularly on the banks of rivers. The rate of growth, despite the long, cold winters and comparatively light annual rainfall, compares very favorably with that of similar species in northeastern United States and Canada.

The greater part of the timber cut in these interior forests is now utilized as fuel, and the author believes that when Alaska's agricultural and mining resources are fully developed these forests will scarcely be equal to supplying local demands because of the smaller size and inferior quality of the timber as compared with that of the coast. Although certain of the species are admirably adapted for pulpwood purposes, the high cost of transportation and the widely scattered nature of the forests will make their general utilization for this purpose highly improbable.

The annual loss from fire in these interior forests at the present time is believed to be greater than the annual increment, and because of the great fire hazard, due to low rainfall and the intense heat of the long summer days, this loss is very difficult to reduce. Artificial reforestation is deemed both impossible and impracticable, in the first place on account of the low rainfall and, in the second, on account of the tremendous interests involved. Fire prevention is considered the only adequate solution, and a plan is suggested for the establishment of a preventive organization which, combined with propaganda to awaken public interest and with closer cooperation on the part of all Federal agencies, should assist in remedying this situation.

Report of the division of forestry (*Mass. Commr. Conserv. and State Forester Ann. Rpt.*, 1921, pp. 29-55, pls. 2).—The more important activities of the year included assistance rendered private owners, care of demonstration forest plantations, the production of young trees, suppression of the gipsy and brown-tail moths, the perfection of a fire prevention system, and the management of the State forests.

The chaulmoogra tree and some related species: A survey conducted in Siam, Burma, Assam, and Bengal, J. F. ROCK (*U. S. Dept. Agr. Bul.* 1057 (1922), pp. 29, pls. 16).—In addition to the main body of the bulletin, there are

included an introductory chapter by D. Fairchild and one on the Chemistry of Chaulmoogra, Hydnocarpus, and Gynocardia Oils, by F. B. Power.

In discussing the history of chaulmoogra oils, the author points out that seeds and oils have been used for centuries by the natives of southeastern Asia for the treatment of leprosy and other skin affections. The genuine chaulmoogra oil is derived from a species known as *Taraktogenos kurzii*, the tree, fruit, and leaves of which are illustrated, and detailed data relating to associated species, methods of harvesting the fruits, etc., based on actual observations by the author, are given. Among related species considered in the bulletin are *Hydnocarpus anthelminthica*, from whose seeds an oil is expressed which is used as a palliative for cutaneous affections; *H. castanea*, with a trunk diameter of 2 ft. and a maximum height of 100 ft., with pointed fruits the size of an orange, which are gathered and used by the natives, who also strip the bark from the trunks for use as a basis for decoctions for internal disorders and skin diseases; *H. curtisii*, observed growing on the island of Penang, attaining a height of only 15 ft., with globose fruits about 1 in. in diameter; *Asteriastigma macrocarpa*, known as the cannon-ball tree, bearing fruits which though much larger than those of *T. kurzii* resemble them closely and yield an oil which agrees closely in chemical composition; and *Gynocardia odorata*, the so-called false chaulmoogra tree, long considered the source of the true oil, the tree, fruit, and manner of fruiting, however, being distinct from *T. kurzii* and the oils obtained by expression of the seeds containing neither chaulmoogric nor hydnocarpic acids.

The survey showed that several species are utilized as sources of chaulmoogra oils. The raw products are largely collected by jungle people, who because of their indolent methods lose about 50 per cent of each crop. Fruiting is apparently irregular and according to the natives occurs generally about once in three years. Suggestions are presented for the establishment of plantations of *T. kurzii*. The paper is concluded with an urgent recommendation that a thorough survey, accompanied by chemical and medical studies, be made of all known species.

Species suitable for planting with teak, W. VERSLUYS (*Tectona* (Boschbouck. *Tijdschr.*), 15 (1922), No. 3, pp. 235-240).—Stating that *Leucaena glauca* has not proved ideal as an interplant for teak on account of its too rapid growth, the author discusses the merits of *Acacia villosa* as a substitute. This species of *Acacia* thrives on calcareous soils, endures dry climates, produces seed of enduring viability, and has proved satisfactory in experimental plantings in Java.

[Forest] seed treatment, A. F. JOSEPH (*Wellcome Trop. Research Labs., Chem. Sect. Pub.* 22 (1922), p. 12).—In connection with plantation experiments with *Acacia arabica* conducted near Khartum, Egypt, various methods of treating seed to assist germination were tested.

Two hours' immersion in sulphuric acid to the amount of half the weight of the seeds treated gave uniformly good results. Concentrated sulphuric acid diluted with an equal part of water gave good results with six hours' immersion, while weaker dilutions did not produce as satisfactory results. Treatment with boiling water or with 50 per cent caustic soda solution did not assist germination. The penetration of the outer seed coat, when accomplished without injury to the embryo, was equally as effective as the concentrated acid treatment.

Liming experiments with forest trees, F. VON FINCKENSTEIN (*Ztschr. Forst u. Jagdw.*, 52 (1920), No. 6, pp. 342-345).—A brief account is given of an investigation begun in 1913 in an attempt to determine the effect of lime upon

Scotch pines growing in an infertile soil. Fresh burnt lime at the rate of 2,000 kg. per hectare (1,760 lbs. per acre) and raw ground limestone at the rate of 4,000 kg. per hectare were worked into the soil with grub hoes, while the check plats were not tilled in any manner. In 1919, after six seasons' growth, remeasurements of the trees on treated and untreated plats showed growth increases of 25.68 per cent for the trees on the limed plats and 19.95 per cent for those on the untreated plats. A conspicuous improvement was observed in the character of the ground flora of the limed areas, various desirable grasses and herbs being present while practically only moss was noticeable on the untreated plats. Soil analyses from both plats showed a higher calcium content for that of the limed areas, indicating the persistent effect of the original lime applications.

Previous experiments on fertile soils showed little or no benefit from the use of lime

DISEASES OF PLANTS.

Plant diseases in the Western Province, I-III, V. A. PUTTERILL (*Union So Africa Dept. Agr. Jour.*, 2 (1921), No. 6, pp. 525-532, figs. 6; 3 (1921), Nos. 3, pp. 259-263, figs. 4; 4, pp. 343-352, figs. 6).—Chlorosis in plum trees is attributed to a general deficiency in plant foods, in humus-forming organic substances, and (possibly) in iron. Black mold, a storage rot, was due to *Rhizopus nigricans*, a wound parasite able to attack at points of very minute injury. This fungus was also associated with blue mold (*Penicillium italicum*). *R. schizans*, recorded as causing a peach stone split in Australia, has not been found in the Western Province. Chrysanthemum rust (*Puccinia chrysanthemi*) was fairly common at Sea Point during the summer.

Seedling orange tree collar rot is successfully treated by exposing the crown roots to dryness, removing diseased portions, and painting the wounds with some disinfectant, such as 50 per cent crude carbolic acid or Bordeaux paste.

Scab or *Fusicladium* of pear or of apple (*Venturia pirina* or *V. macqualis*, respectively) was destructive in the Western Province. Varietal cases of partial or total immunity are noted. Protective measures are outlined.

[The timely and general employment of protectives against plant diseases], W. LANG (*Angew. Bot.*, 1 (1919), pp. 156-177).—Information having practical bearings is presented in a review, with a discussion of plant disease and of protective measures.

The toxicity of metals, FONZES-DIACON (*Prog. Agr. et Vitic (Ed. l'Est-Centre)*, 42 (1921), No. 4, pp. 90-92).—A brief review is given of contributions and opinions cited regarding the toxicity of metallic compounds in solutions as used against plant diseases.

The use of sugar in Bordeaux mixture, A. A. RAMSAY (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 12, p. 909).—It is considered improbable that copper saccharate is formed by the addition of sugar to copper sulphate in the quantities used for preparing Bordeaux mixture. It is thought that calcium saccharate is formed, owing to the increased solubility of lime in a weak sugar solution as compared with water alone, and that this calcium saccharate has not the same action on the various basic copper sulphates present that occurs in case of an aqueous solution saturated with lime.

The addition of sugar to Bordeaux or Burgundy mixture seems to have gone out of general field practice, as better results are now obtained by the use of casein, 5 oz. being used to 50 gal. of the spray mixture.

The use of casein in fungicidal sprays, P. MARSAIS (*Rev. Vitic.*, 52 (1920), No. 1354, pp. 397-399).—Giving quotations from his own statements previously

published, the author notes that the addition, together, of lime and casein to complete the spray liquid results in incomplete admixture, and in the production of lumps. A mixture of casein and ammonium sulphate is quickly dissolved, and Bordeaux with such addition is said to give satisfaction in every essential.

Laboratory studies of the toxicity of some sulphur fungicides, W. L. DORAN (*New Hampshire Sta. Tech. Bul. 19 (1922), pp. 3-11*).—The author states that the fact that lime sulphur may or may not control apple scab in New Hampshire led him to make an investigation of the subject, with the object of determining the conditions which must obtain in order for lime-sulphur solution to act as a fungicide. Lime-sulphur solutions were prepared in different concentrations and sprayed on glass slides, after which the surfaces were allowed to dry in the laboratory. After 24 hours they were inoculated with conidia of apple scab fungus (*Venturia inaequalis*) suspended in distilled water. When examined 24 hours later, it was found that lime sulphur had not prevented the germination of the spores.

It is claimed that lime sulphur, when dried on a tree, remains on the sprayed surface in the form of free sulphur, calcium thiosulphate, calcium sulphite, calcium sulphate, and calcium carbonate. The toxicity of calcium sulphate, calcium sulphite, sulphur, and precipitated sulphur was tested, and it was found that calcium polysulphid decomposed most rapidly and decreased in fungicidal efficiency when dried slowly. Sulphur was toxic only when oxygen was present. The toxicity of sulphur to fungi increased with rise of temperature and length of time of exposure. Precipitated sulphur proved more toxic to the conidia of the apple scab fungus than finely ground sulphur, and it acted at lower temperatures. Fungi were found to differ in their susceptibility to the toxic action of the sulphur.

A bacterial root and stalk rot of field corn, H. R. ROSEN (*Phytopathology, 11 (1921), No. 2, pp. 74-79, figs. 4; abs. in Phytopathology, 11 (1921), No. 1, pp. 32, 33*).—The author reports a disease of field corn that has been observed in widely scattered areas in Arkansas, and which at times destroys or renders useless from 20 to 30 per cent of the stalks. The disease in question is characterized by a rotting accompanied by a light or dark brown discoloration of the nodes, usually the lower ones. Under high humidity and temperature, the rot extends through the entire thickness of the stem, the tissue collapses and disintegrates, and the stalks fall over. Roots, leaf sheaths, leaf blades, and husks are also attacked. A bacterial organism has been isolated from these materials, and infections were produced by inoculations with the organism.

Kernel starchiness as an index of susceptibility to root, stalk, and ear rots of corn, J. F. TROST and G. N. HOFFER (*Abs. in Phytopathology, 11 (1921), No. 1, pp. 33, 34*).—In an experimental test of over 2,000 seed ears, covering various degrees of starchiness, it was found that starchy ears of corn of certain dent varieties produced larger numbers of weaker-growing stalks and the plants were more susceptible to root rot than plants from ears more horny in composition, irrespective of whether the starchy kernels were infected with species of *Fusarium* before planting.

The improved rag-doll germinator as an aid in controlling root, stalk, and ear rots of corn, B. H. DUDDELETON and G. N. HOFFER (*Abs. in Phytopathology, 11 (1921), No. 1, p. 33*).—Attention is called to an improved rag-doll germinator used in the corn root and stalk rot investigations conducted co-operatively between the Bureau of Plant Industry, U. S. D. A., and the Indiana Experiment Station. In a test of this germinator in which more than 11,500 ears of corn were examined in 1920, 27 per cent showed serious infections of *Fusarium* spp. and *Diplodia*.

Three methods of controlling the root, stalk, and ear rots of corn, G. M. SMITH and G. N. HOFFER (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 34).—The authors recommend field selection of seed ears of sweet corn from apparently healthy stalks, artificial drying by heat, and testing seed ears for germination and infection. Each of these, or all combined, have been found profitable in reducing the amount of infection with *Fusarium* spp.

Selection of disease-free seed and seed treatments as possible means of control of corn root rot, W. D. VALLEAU (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 35).—Selections made at various stages of maturity have not yielded any disease-free seed, and the results obtained are believed to indicate that infection takes place before the early dough stage of the grain. It probably occurs through the silks and is a result of infection of the exposed silk mass with *Fusarium moniliforme*. Attempts to control corn root rot by seed treatment have given negative results.

A Fusarium wilt of corn in Iowa in 1920, J. C. GILMAN (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 33).—A disease of corn was observed in the field when the plants were about 6 in. high, at which time some of the plants showed marked tipburn of the leaves, accompanied at times by the wilting of the plants. Upon examination of the plants affected, there was found to be a brown discoloration of the vascular system at the base of the stalk. Isolations showed the presence of a *Fusarium* in 93 per cent of the cases examined. The disease in question corresponds with the early stage of root rot as generally described, but differs in that the hills which showed the wilt did not exhibit broken, leaning, or down stalks at harvest time, but were the most erect plants in the field. In addition, the presence of this wilt was not indicated by discoloration of the seedlings on the germinator.

Significant points in the life history of the Philippine maize mildew, W. H. WESTON, JR. (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 32).—The author reports several *Sclerosporas* occurring on corn in the Orient which have not yet been introduced into this country. A study of one occurring in the Philippines shows that the conidia of this *Sclerospora* were produced only in the night when the leaves were covered with a layer of dew or other moisture. The period of infection may cover several months, and, consequently, one diseased plant may be the source of infection for a wide area. The conidia may be produced on corn, teosinte, sorghum, sugar cane (*Saccharum spontaneum*), and *Miscanthus japonicus*, but oogonia have been found only on the last three host plants. Conidia are apparently not able to survive drying, and the author thinks that the spread of this disease to different countries will have to take place through the transportation of oogonia, either in the soil or through infected plants.

Studies on corn rust, G. F. WEBER (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 31, 32).—Studies are reported on the overwintering, relation of temperature to germination, method of host penetration, and relative susceptibility of corn species and varieties to urediniospores of *Puccinia sorghi*.

Ecologic and physiologic notes on corn smut (*Ustilago zeae*), L. E. MELCHERS (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 32).—It has been found that cultures of *U. zeae* differ in their power to produce infection, and there appears to be an indication that the nature of the corn plant, and the change of environmental conditions with its effect on the host, are not solely responsible for such striking differences in smut resistance or susceptibility. The investigations are believed to indicate that there are physiological differences in the corn-smut organism that may be of considerable importance in the breeding of corn for resistance to it.

Experiments with Stewart's disease on dent, flint, and sweet corn, C. H. REDDY (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 31).—Tests were conducted in greenhouses during the winter of 1919–20 to determine the relative susceptibility of dent, flint, and sweet corn to bacteria of the *Aplanobacter stewartii* type isolated from natural infections of the different types of corn. Cross inoculations were made with water suspensions of cultures from the three kinds of corn, and the results indicate that the organism isolated from each was about equally pathogenic to all the hosts under experimentation. No type of corn showed any marked resistance.

Infection experiments with Claviceps, F. T. MCFARLAND (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 41, 42).—As a result of cross inoculation experiments, the author has found that rye can be readily inoculated by using conidia from the honeydew from ergotized florets, from the surfaces of matured sclerotia, and from pure cultures. In all cases the infections were made when the floral glumes were wide open, effective results following inoculations made both at earlier and later stages. Successful inoculations upon rye have been secured from the honeydew stage of *Bromus inermis*, *Agropyron repens*, *Poa pratensis*, and *Arrhenatherum elatius*. With wheat some difficulty was experienced in securing infection, although positive results were obtained in a few cases when conidia were used from either rye, *A. elatius*, *P. pratensis*, or *A. repens*. In general cross inoculations gave a higher percentage of success where made from one of the above grasses to another than when made from grass to rye.

Loss from rye ergot, E. K. SEYMOUR and F. T. MCFARLAND (*Phytopathology*, 11 (1921), No. 7, pp. 285–289, figs. 2; *abs. in Phytopathology*, 11 (1921), No. 1, p. 41).—Observations and exact counts have shown that the loss caused by ergot (*Claviceps purpurea*) in rye is represented not only by the actual number of sclerotia but also by a large number of blasted kernels and empty florets. Of 730 ergotized spikes 47 per cent of the florets either held blasted kernels or were empty, and 10 per cent held sclerotia. Of 651 unergetized spikes only 31 per cent of the florets either held blasted kernels or were empty. In all cases the diseased spikes were shorter in length and lighter in weight than those not affected by the fungus.

The effect of certain chemicals, especially copper sulphate and sodium chlorid, on the germination of bunt spores, N. F. THOMPSON (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 37, 38).—In experiments carried on to determine the concentration of the solution and the length of treatment necessary to cause the death of bunt spores (*Tilletia tritici* and *T. laevis*), copper sulphate and common salt proved the best treatment. The strongest copper sulphate solution used only retarded the germination of the spores, while a relatively high dilute solution of copper sulphate and sodium chlorid practically inhibited all growth.

Chemical dusts for the control of bunt, W. W. MACKIE and F. N. BRIGGS (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 38, 39).—Experiments were conducted with flowers of sulphur and the dusts of copper sulphate and copper carbonate for the prevention of bunt. In 1919, seed heavily smutted when mixed with flowers of sulphur gave 41.5 per cent of smutted heads, while with copper sulphate there were produced 21.9 per cent as compared with 84.1 per cent with untreated seed. In 1920, flowers of sulphur applied at the rate of 25 to 100 lbs. to each 100 lbs. of seed reduced the amount of smut from 61.8 to 6.3 per cent. Dusting seed with copper sulphate and copper carbonate at the rate of 2 oz. per bushel gave very satisfactory results.

The influence of soil temperature on the development of the seedling blight of cereals caused by *Gibberella saubinetii*, J. G. DICKSON (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 35, 36).—Parallel series of clean and infected wheat and corn seedlings were grown under greenhouse conditions in constant soil temperatures varying by 4° C. The uninfected wheat seedlings developed the largest root systems and the heaviest total dry weight at soil temperatures below 16° C. (60.8° F.), while corn seedlings produced the largest root systems and greatest total dry weight at soil temperatures above 20°. The maximum temperature for the development of the blight organism on wheat was about 32°, and none was observed when the temperature was held at 36°. Corn seedlings inoculated with the parasite were badly infected at the soil temperature of 20° and below, and did not blight above 24°. Field plantings made at Madison, Wis., gave results which correlate very well with the greenhouse experiments given above.

Hydrogen-ion concentration of the soil and seedling infection by *Gibberella saubinetii*, E. F. HOPKINS (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 36, 37).—Wheat seed treated with a spore suspension of cultures of *G. saubinetii* were planted in plats in the greenhouse, and counts made of the seedlings as they appeared showed a marked depression at pH 5.8. At the end of three weeks the greatest amount of infection was shown in the most acid and the most alkaline cultures with a minimum in the curve of a pH of about 5.5.

Growth and germination of *Gibberella saubinetii* at varying hydrogen-ion concentrations, E. F. HOPKINS (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 36).—The effect of acidity on the growth of the wheat scab organism was determined, based on the amount of dry weight of the mycelium produced at the end of 4, 7, and 14 days in different solutions. In all three series the amount of growth increased with decreasing acidity from pH 2.5 to a maximum of pH 4.0 to 4.5. It was then decreased to a minimum at pH 5.0 to 5.5 and again arose to a second maximum, the highest point of which was not determined.

Using the same solutions, the effect of the hydrogen-ion concentration on the spore germination of *G. saubinetii* was studied, and the results are said to indicate that conidial germination also shows a double maximum.

Second progress report on the Fusarium blight (scab) of wheat, J. G. DICKSON, H. JOHANN, and G. WINELAND (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 35).—In continuation of studies on Fusarium blight or scab of wheat due to *Gibberella saubinetii*, the authors report the examination of a large number of specimens of wheat received from 16 Central and Eastern States, 98 per cent of which yielded the fungus. In addition, *F. avenaceum* and *F. culmorum leticius* were isolated from a few specimens. Inoculation experiments indicate that the highest percentage of infection occurs during the period of flowering, the initial infection usually taking place through the extruded anthers.

The regional occurrence of *Puccinia graminis* on barberry, E. C. STAKMAN, R. S. KIRBY, and A. F. THIEL (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 39, 40).—Investigations were undertaken to ascertain the limits of barberry infection and to determine why infection did not occur in the South.

It was found that east of the Rocky Mountains barberry infection is most prevalent and most severe north of 40° N. lat., although at high elevations there was a heavy infection as far south as 37°. Barberries do not become infected in the Southern States when inoculated with teliospore material which has been developed in the South, but when inoculated with teliospores from the North, they became very heavily infected. Teliospores from the South kept in the North during the summer and fall caused infection in the

South, while northern teliospores kept in the South did not cause infection. It is believed that the reason why barberries do not become infected in the South is because practically no teliospores are viable in the spring.

Two strains of *Puccinia triticina* on wheat in the United States, E. B. MAINS and H. S. JACKSON (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 40).—It is reported that certain varieties of wheat showed a high degree of resistance to *P. triticina* when grown in a wheat nursery at La Fayette, Ind. When certain uredinial cultures of the rust were sown on seedlings of these varieties in the greenhouse a difference in reaction was noted, and some of the varieties were heavily infected by all cultures in the seedling stage. An explanation is offered that this is due to a difference in the susceptibility of the varieties according to maturity, that they are moderately susceptible in the seedling stage but highly resistant as they mature. On the other hand, some varieties were found to show resistance in the seedling stage. This is believed to indicate different strains of the fungus used, and in 1920 uredinial cultures were made which resulted in a separation of these cultures into two groups, based on their ability or inability to infect selections of varieties.

Helminthosporium and wheat foot rot, F. L. STEVENS (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 37).—Investigations show that with seedlings grown under aseptic conditions inoculations by spores of *Helminthosporium* upon the uninjured sheath were followed within 24 hours by the entrance of the mycelium into the host cells, and within 48 hours by a browned, diseased spot visible to the naked eye. It is claimed that, aside from the *Helminthosporium* originally isolated, several variant, closely related types have been found. Infection by the foot-rot *Helminthosporium* has been secured on corn, barley, rye, corn fodder, Sudan grass, and millet.

The so-called take-all disease of wheat in Illinois and Indiana, H. H. McKINNEY (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 37).—This disease, which is reported to have been present in Illinois and Indiana in 1919, recurred in 1920 in Madison County, Ill., and in Porter County, Ind. The disease was less severe in 1920 than during the previous season, and this is thought to have been due to the fact that few varieties which showed the disease in 1919 were sown in 1920. The most promising means of control is believed to be in the use of resistant varieties, a number of which are noted. A study of the lesions is believed to indicate that the disease in Illinois and Indiana may be an unusual manifestation of the *Helminthosporium* disease of wheat present in many regions.

Occurrence of *Rhynchosporium* on *Dactylis glomerata* and *Bromus inermis*, C. DRLESER (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 42).—The author reports finding *R. secalis* attacking *D. glomerata* and *B. inermis* at Madison, Wis., during May, 1920. So far as known, no records of the occurrence of this parasite on either host have been hitherto reported.

A disease of beans, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 57 (1921), Spanish ed., pp. 3-8, fig. 1).—A destructive bean disease due to *Rhizoctonia microsclerotia* is described.

The relation of mosaic disease to pickling of cucumbers, M. B. CHURCH (*Phytopathology*, 11 (1921), No. 1, pp. 28, 29).—Attention is called to the necessity of carefully examining cucumbers for use in the preparation of pickles where the mosaic disease is known to be prevalent. Cucumbers were grown during the summer of 1920 at Arlington Farm, Va., for pickling purposes. The fruits showed the presence of mosaic disease late in the season, and it is believed that earlier cases were overlooked. Fresh cucumbers affected by the disease had a bitter taste and their texture was tough. When placed in

pickling solutions certain physical changes were observed. Some of the cucumbers had white areas with a tough, woody texture which did not clear up during the pickling process, while others became soft or spongy. The investigation indicates that cucumbers visibly affected with mosaic will not cure properly in the pickling vat.

Measuring certain variable factors in potato seed treatment experiments, I. E. MELHUS and J. C. GILMAN (*Phytopathology*, 11 (1921), No. 1, pp. 6-17, figs. 5).—Attention is directed to the varying effect of seed treatment for the control of scab (*Actinomyces scabies*) and Rhizoctonia on potatoes. The results are given of field and laboratory experiments with formaldehyde and corrosive sublimate treatments applied in various ways. The lack of consistent behavior is attributed to varying factors, among which are the presence of the living pathogenes on the tubers after they have been treated, the antiseptic action rather than disinfecting qualities of some of the fungicides in surface disinfection of seed tubers, and the percentage of infection resulting from the presence of the pathogene in the soil.

The life history and cytology of *Synchytrium endobioticum*, the cause of wart disease in potato, K. M. CURTIS (*Roy. Soc. London, Phil. Trans., Ser. B*, 210 (1920), No. B 380, pp. 409-478, pls. 5, fig. 1).—After an introduction and an outline of the life history of the potato wart disease organism (*S. endobioticum*), this account deals in the several divisions with the method of investigation; the morphology of the prosorus and sorus; chapters dealing with these in detail; the zygote; the resting sporangium; and a general discussion including the relation of fungus and host plant, the persistence of the organism in the soil from year to year, immunity from wart disease, nuclear reduction, the relation of the fungus to the genus *Pycnochytrium*, and sexuality in the *Synchytriaceae*. A bibliography is given of about 50 titles representing widely separated regions.

A root rot of sugar cane, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 56* (1921), *Spanish ed.*, pp. 5-12, fig. 1).—A description is given of a root rot of sugar cane due to *Plasmiodiophora* sp. The disease is said to be widely distributed, and the more important varieties of cane cultivated in Porto Rico are reported subject to attack of the fungus. Suggestions are given for means of controlling the disease.

Seed-bed rot of tobacco, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 55* (1921), *Spanish ed.*, pp. 3-5).—A description is given of a serious rot of tobacco seedlings, with suggestions for its control. The method recommended is the disinfection of the seed bed by chemicals, such as copper sulphate, formaldehyde, sulphuric acid, and zinc chlorid.

Tissue breakdown in fruits and vegetables, R. NELSON (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 44, 45).—According to the author, the diseases known as "black leaf speck" of cabbage, "red heart" of Iceberg lettuce, and various surface spots of grapefruit, orange, and lemon are due to tissue breakdown, commonly induced by conditions of poor ventilation in storage and transportation.

Orchard spray program for 1922, H. P. BARSS and A. L. LOVETT (*Better Fruit*, 16 (1922), No. 8, pp. 8, 9, 27, fig. 1).—Notes and tabulations relate to treatments for protection against plant diseases and injurious animals.

Control of anthracnose, or black spot canker, E. W. WHITE (*Better Fruit*, 16 (1922), Nos. 8, pp. 7, 21, fig. 1; 9, pp. 12, 18, 19).—Apple tree anthracnose, or black spot canker, is said to be prevalent wherever adequate control measures are not maintained, in practically all apple orchards of the coast districts of Oregon, Washington, and British Columbia. It is probably the most serious fungus disease with which the coast fruit grower has to deal, and during the

last 25 or 30 years has caused the destruction of a great number of apple trees. The purpose of this paper is to give briefly the results of 5 years' experimental work in the control of this disease in the Keating district near Victoria, Vancouver Island, B. C. The work herein detailed (in connection with conditions and varieties), as continued during 1916-1920, is thought to indicate that this disease can be almost absolutely controlled by appropriate concerted action.

Gummosis of the cherry, C. A. TONNESON (*Better Fruit*, 16 (1922), No. 9, pp. 14, 15, 22).—Field observations of cherry tree gummosis have led to the conclusion that late fall growing, with unripened condition of cambium and sapwood, is a prevalent cause of the trouble, though bacterial and other factors may exist.

Recent studies on peach yellows and little peach, M. A. BLAKE, M. T. COOK, and C. H. CONNORS (*New Jersey Stat. Bul.* 356 (1921), pp. 62, pls. 2, figs. 28).—In the investigation of some of the problems of commercial peach growing, orchards were planted under the direction of the station in 1906, 1907, 1908, and 1912. The presence of these orchards offered opportunity for studies on peach diseases, especially peach yellows and little peach. The behavior of every tree was studied, and from the data thus accumulated and from observations made elsewhere the authors have presented their conclusions.

It is claimed that these diseases, especially peach yellows, are not of recent appearance, and that they cause heavy losses in the eastern peach districts of the United States. The symptoms of the diseases are described at some length, and the results of experiments are said to show that pits from badly diseased trees seldom germinate. Those from slightly affected trees germinate and usually produce healthy trees. Buds from diseased trees when inserted in healthy stock showed symptoms of disease in from eight months to four years. Breeding experiments are said to indicate that the diseases in question are not transmitted by pollen. Trees in some soils seem more readily affected than others, the reason for which has not been determined. Fertilizers had no effect in controlling the disease, and conflicting data were secured regarding varietal susceptibility, progress and spread of the diseases, etc. Replanted trees were found no more liable to disease than others.

Suggestions are given for keeping down losses due to these diseases. The means recommended include selection of favorable sites, planting clean, vigorous trees, good cultivation, and the prompt removal of diseased trees.

Leaf scorch or mollisiase of strawberry, R. E. STONE (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 44).—A report is given of a common disease of the cultivated strawberry in southern and eastern Ontario, due to *Mollisia caribana*, the perfect or ascigerous stage of *Marssonina potentillae*.

Rhizopus sp. associated with a decay of unripe strawberries in the field, L. E. MELCHERS (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 44).—The author reports observations in 1919 and 1920 on unripe strawberries attacked by *Rhizopus*. In some fields from 25 to 35 per cent of the fruit being destroyed.

Winter injury to berry plants, J. L. STAHL and A. FRANK (*Better Fruit*, 16 (1921), No. 5, p. 10).—Factors named as producing almost every year spring (frost) injury to berry plants in western Washington are late irrigation or early fall rains; poor drainage; continued cultivation late in the season; neglect to thin young canes; late summer fertilizing; excessive fertilization; warm, wet fall followed by low temperatures; summer drought, producing weak canes; and late frosts, injuring new shoots.

Factors tending to prevent winter (freezing) injury include good soil drainage; good air drainage; frequent cultivation during the early growing season; and early normal ripening of canes.

Study of a blackberry disease, C. HAHMANN (*Angew. Bot.*, 1 (1919), pp. 103-111, figs. 4).—A canker of blackberry stems associated with a fungus described in the same connection by Güssow (E. S. R., 20, p. 850) is thought to have its origin in the numerous small wounds produced in the stems by its own thorns, owing to wind and other movements. Notes are given on management of diseased plants.

Contributions on the biology of the vine, E. PANTANELLI (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), Nos. 4, pp. 87-89; 5, pp. 111-115; 7, pp. 161-165).—An account is given of experimentation and observations on conditions of attack and resultant severity of outbreak, and on fungicidal treatments of grapevines, extending as far back as 1911.

Homemade Bordeaux v. powders and paste, R. G. DOWNING (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 12, p. 894).—Experimentation carried out at the Narara Viticultural Nursery for two seasons to determine the best preventive of grape downy mildew and black spot, and the proper period of application, shows that the use of ordinary Bordeaux mixture (6:4:40), if applied early in the season, is the most dependable method.

Copper and grape downy mildew, G. VILLEDIEU (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 5, pp. 119, 120).—The argument is continued (E. S. R., 46, p. 745) on the behavior of copper in fungicidal sprays.

Villedieu's experiments on grape downy mildew and copper salts (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 8, pp. 193, 194).—Further discussion is offered regarding the claims of Villedieu.

The toxicity of copper salts, FONZES-DIACON (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 6, pp. 137-139).—This is part of the discussion participated in by Villedieu, as above noted.

Copper sprays for grape downy mildew, J. CHAUZIT (*Rev. Vitic.*, 52 (1920), Nos. 1352, pp. 361-364; 1353, pp. 377-383; 1354, pp. 395-397).—The question of the most appropriate (effective, safe, and economical) treatment for grape downy mildew is here discussed (in the light of former and recent experimentation and opinion) regarding the available effective preparations; relative values of acid and of alkaline Bordeaux mixture; augmentation and maintenance of the efficiency of alkaline Bordeaux; preparation of spreading and adherent sprays; and number, time, and character of the applications.

Bordeaux mixture: Should it be acid or alkaline? F. DE CASTELLA (*Jour. Dept. Agr. Victoria*, 18 (1920), No. 12, pp. 749-754).—Discussing the main question of the advantage from spraying, the author reviews the history of copper spraying, and notes with emphasis points in the review by Chauzit, above noted.

Acid and neutral Bordeaux yield rather more soluble copper for the first few days after spraying, but the alkaline preparation was found to surpass both in this respect after a few days. Also the protecting reserve of copper left on the leaves is more lasting and very much less subject to removal by rain in case of the alkaline preparation. Alkaline Bordeaux also permits the addition of casein (which curdles in the acid preparation), with its own contribution as regards spreading and adherence. Burgundy mixture is not so desirable, as it must be neutral or slightly acid to avoid scalding the foliage.

Spraying experiments for the control of pecan scab in Mississippi, D. C. NEAL (*Mississippi Sta. Bul.* 203 (1921), pp. 3-14, figs. 9).—An account is given of spraying experiments conducted in 1921 for the control of pecan scab due to *Fusicladium effusum*. The results obtained indicate that pecan scab can be successfully controlled by spraying with Bordeaux mixture.

Winter injury to young walnut trees during 1921-22, L. D. BATCHELOR (*California Sta. Circ.* 234 (1922), pp. 5, figs. 3).—According to the author, one

of the most common causes of winter injury to walnut trees is the early fall frosts which occur before the trees become dormant. The frosted foliage drops before maturity, and hence the green, immature twigs are exposed to the sun's heat during the bright days of fall and winter. In many cases the twigs show no actual injury at the time of the frost but are eventually killed when they show a marked sunburning following the loss of the leaves. The death of the immature twigs is apparently due not so much to the low temperature which killed the leaves as to the subsequent sunburning.

Injury from frost may be prevented by resorting to means to secure the maturing of trees early in the autumn.

Hevea diseases (*Bul. Assoc. Planteurs Caoutchouc*, 8 (1921), No. 1, pp. 7, 8).—A brief account is given of the appearance, in 1916, of Hevea black stripe canker and of moldy rot, with statements regarding the influence of conditions and remedial measures in use.

Witches' brooms of *Pinus maritima*, J. DURENOY (*Phytopathology*, 11 (1921), No. 1, p. 27).—The author reports that witches' brooms are often produced from a local hypertrophy of lateral shoots on *P. maritima* in southwestern France, and examinations of the hypertrophied shoots show the presence of a large number of bacteria. Bacteria which had been isolated were cultivated in media and inoculated into buds of *P. maritima*. The inoculations resulted in the death of the buds, and the tissues were found swarming with bacteria, but no witches' brooms were formed. The experiment is believed to prove the parasitism of the organism, but it leaves uncertain whether the bacteria are the cause of the witches' broom formation.

The effect of incipient decay on the mechanical properties of airplane timber, R. H. COLLEY (Abs. in *Phytopathology*, 11 (1921), No. 1, p. 45).—Pieces of Sitka spruce and Douglas fir showing incipient decay were tested, and the effect of *Panicea pinicola*, *P. laticus*, and *Polyporus schweinitzii* was decidedly more marked than that of *Trametes pini*. The results of the investigation indicate the necessity for careful inspection of incipient decay in forest and mill to prevent the expense of working and finishing defective stock.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A study of the body temperature of birds, A. WETMORE (*Smithson. Misc. Collect.*, 72 (1921), No. 12, pp. 52).—This is a detailed report of extended investigations conducted by the Biological Survey, U. S. D. A. Following an introduction, the author considers the method of securing avian body temperatures, diurnal rhythm in temperature, variation in temperature in relation to sex, external temperature in relation to bodily heat, diverse miscellaneous factors in their relation to body temperature, temperature of young, method of temperature control in birds, significance of temperature control, and discussion of differences in average temperatures. The data on which the discussion is largely based are presented in detail in tables covering 16 pages. A bibliography of 38 titles is included.

Seventh annual list of proposed changes in the A. O. U. Check List of North American Birds, H. C. OBERHOLSER (*Auk*, 39 (1922), No. 2, pp. 243-249).—This is a continuation of the lists previously noted (*E. S. R.*, 45, p. 358).

The European pileworm: A dangerous marine borer in Barnegat Bay, N. J., T. C. NELSON (*New Jersey Star. Circ.* 139 (1922), pp. 15, figs. 9).—This is a general summary of information on the European pileworm (*Teredo navalis* L.), a heavy invasion of which was discovered by the author by accident during the course of oyster investigations being conducted in Barnegat Bay in the summer of 1921. This mollusk has for centuries literally ravaged the coasts

of Holland, England, and Scandinavia, destroying dikes and other marine structures with great rapidity. It has become established in San Francisco Bay, Calif., having been first discovered there in 1914. During the first five years it did but little damage, but suddenly in 1920 attacks became widespread over a large part of that bay. A careful estimate showed the damage done during 1920 and 1921 to be in excess of \$15,000,000. That the European pileworm is much more dangerous than the native species, (*Xylotrypa*) *Bankia fimbriata* Jelf., is due to the fact (1) that it invades the brackish water area and comes much closer to fresh water than do other borers and (2) that it requires but a very short time to reach sexual maturity, and in a single season produces enormous numbers of young.

The more important points in its life history and bionomics are reviewed. It is pointed out that in its evolution the shell, which was originally developed entirely for protection, has become modified into a tool by means of which it bores. In his investigations at Samoa in 1920, Potts¹ found that with water temperatures ranging from 80 to 86° F. *T. navalis* became sexually mature within 24 days of the time it entered the wood. At Barnegat Bay breeding teredos have been found in less than 6 weeks from the time they attached themselves to the wood, at which time they averaged only 4 1/2 in. in length. While it is not known how long the larvae of *Teredo* remain free-swimming in the water, it is believed to be about one month in San Francisco Bay. It is pointed out that one teredo liberates from 500,000 to 1,000,000 larvae in a season. Fortunately a great majority of marine borers die before spring of each year, only a few living to propagate the species. It is concluded from the observations made of the larvae of *Teredo* at Barnegat Bay that the growth of the pileworms to sexual maturity and the complete destruction of the platform used must have occurred in about 5 weeks.

In considering the seriousness of the situation, attention is called to the fact that while the native shipworms (*B. fimbriata*) apparently do not live in waters the density of which is below 1010 for any long periods, experience in San Francisco Bay has shown that the European pileworm may survive for long periods and do great destruction where the salinity of the water at no time rises above 1006.

In discussing means of protection, it is pointed out that infested wood should be removed immediately, and old vessels, discarded wharfing, and other abandoned wooden structures should be carried away to avoid a possible source of infestation of near by structures. Thoroughly creosoted piling stood up fairly well in San Francisco Bay during recent infestations, yet even in wharves having the best records, standing entirely on creosoted piling, as high as 30 per cent showed more or less infestation by the *Teredo*. In concluding the author recommends that immediate inspection be made of the various structures in Barnegat Bay and even where the piles have been creosoted.

Observations on the ensheathed larvae of some parasitic nematodes, T. GOODEY (*Ann. Appl. Biol.*, 9 (1922), No. 1, pp. 33-48, fig. 1).—The author finds that the eggs of *Graphidium strigosum* and *Trichostrongylus retortaeformis* give rise, under suitable cultural conditions, to larvae which finally become ensheathed and wander from the culture medium. A new and easily manipulated method of experimentation for skin infection work is described.

The geographical distribution of the Indian rat fleas as a factor in the epidemiology of plague: Preliminary observations, F. W. CRAGG (*Indian Jour. Med. Research*, 9 (1921), No. 2, pp. 374-398, pls. 2, figs. 3).—The details of investigations of the geographical distribution of Indian rat fleas are presented in tabular form.

¹ Carnegie Inst. Wash. Yearbook 19 (1920), pp. 197, 198.

Notes on rearing insects in hot climates, T. B. FLETCHER and C. C. GHOSH (*Agr. Research Inst., Pusa, Bul. 112 (1921), pp. 875-892, pls. 8*).—This is a reprint of a paper from the proceedings previously noted (E. S. R., 45, p. 657).

Hints on collecting and preserving insects, T. B. FLETCHER (*Agr. Research Inst., Pusa, Bul. 113 (1921), pp. 936-974, pls. 16*).—This is a reprint of the paper published in the proceedings previously noted (E. S. R., 45, p. 657).

The division of insects in the United States National Museum, J. M. ALDRICH (*Smithson. Inst. Ann. Rpt., 1919, pp. 367-379, pls. 15*).—This subject is dealt with under the headings of history, functions, installation, inventory, personnel, and illustrations.

Thirteenth report of the State entomologist and plant pathologist, 1920-21, W. J. SCHOENE (*Va. State Crop Pest Comm. Quart. Bul., 3 (1922), No. 4, pp. 30, figs. 4*).—Included in this report are accounts of observations of the codling moth, the Oriental peach moth, the squash lady beetle on watermelon, and the woolly apple aphid.

In a comparison of spray mixtures as destroyers of aphid eggs it was found that solutions of crude carbolic acid containing 0.25 per cent, 0.5 per cent, and 0.1 per cent did not affect the hatching of the eggs at the time when these applications were made (February 11 and March 1). Miscible oil and lime sulphur applied on the same dates did not materially influence the hatching of the eggs, although nicotine and soap proved effective in destroying a large percentage.

[**Work with economic insects**] (*Hawaii. Sugar Planters' Assoc. Proc., 40 (1920), pp. 150-156*).—This review of the work with economic insects during the year 1920 indicates that the application of insecticides for leafhopper control does not affect the leafhopper eggs within the leaves nor the developing parasites in the leafhopper eggs. Mention is made of the introduction from Australia of a small bug, *Cyrtorhinus mundulus*, which sucks the leafhopper eggs of their contents, a reference to which has been previously noted (E. S. R., 45, p. 551). A study is being made of the scale *Antonina australis*, which lives on nut grass, with a view to introducing it as a means of combating this grass pest. The valuable parasite *Scolia manilae*, introduced from the Philippines as a means of control for the Anomala beetle, continues to maintain its existence and spread even though in some localities it is dependent upon the larvae of the Japanese rose beetle Adoretus.

The wireworm *Monocrepidius exul*, previously known only as a predator, has become a source of injury to young cane by attacking the eyes and tender shoots. Mention is made of the introduction of *Coccinella arcuata* and the lacewing fly *Micromus vinaceus* from Australia as enemies of aphid.

Agricultural entomology of Brazil, C. MOREIRA (*Min. Agr., Indus. e Com., Inst. Biol. Defesa Agr. [Brazil] Bol. 1 (1921), pp. V+182, pls. 61, figs. 25*).—This is a manual dealing first with the anatomy and physiology of insects, followed by accounts of the more important insect pests arranged under the crops attacked, with control measures.

Swedish insects: A handbook for the study of economic insects, I. A. TULLGREN and E. WAHLGREN (*Svenska Insekter: En Orienterande Handbok vid Studiet av Vårt Lands Insektfauna. Stockholm: P. A. Norstedt & Sons, 1920, vol. 1, pp. 176, pls. 3, figs. 137*).—This volume deals first with the anatomy of insects, their reproduction (pp. 15-28), collection and preservation (pp. 28-41), etc. This is followed by a systematic account of 15 of the orders of insects, including Orthoptera, Thysanoptera, and Hemiptera, with tables for the separation of families and genera, accompanied by illustrations and three plates in colors.

The control of plant diseases and insects, G. E. RITCHEY (*Univ. Nanking, Agr. and Forestry Ser.*, 1 (1921), No. 4, pp. 20, fig. 1; *Chinese ed.*, pp. 20, fig. 1).—This is a popular summary of information issued in Chinese and English editions.

Economic zoology, T. B. FLETCHER and C. F. C. BEESON (*India Bd. Sci. Advice, Ann. Rpt. 1919-20*, pp. 47-53).—This consists of a report by Fletcher on agricultural entomology (pp. 47-50) and by Beeson on forest entomology (pp. 51-53).

Annotated list of Indian crop pests, T. B. FLETCHER (*Agr. Research Inst., Pusa, Bul. 100* (1921), pp. 246, pls. 9).—This is a reprint of the list given in the proceedings previously noted (E. S. R., 45, p. 656).

Some insects recently noted as injurious in South India, T. V. RAMAKRISHNA AYYAR (*Agr. Research Inst., Pusa, Bul. 101* (1921), pp. 314-328, pls. 12).—In this paper, which is a reprint from the proceedings previously noted (E. S. R., 45, p. 656), the author brings together brief accounts of several new insects of economic importance that have been noted in South India during the last three or four years.

Annual report of the entomologist to the Government, Punjab, M. AKZAL HUSSAIN (*Punjab Dept. Agr. Rpt.*, 1920, pl. 2, p. 173-184).—This report deals with a few of the more important pests upon which work was centered during the year, particularly the cotton bollworms *Varis insulana* Boisd and *E. fabia* Stoll.; the mango hopper, *Idiocerus* sp.; and a psyllid pest of citrus, *Euphaterus citri* Kuw. A brief report on sericultural work includes tabular data on the distribution of silkworm seed in the Province for the years 1918-1920.

Insect pests of various minor crops and fruit trees in Mauritius, D. D'EMMEREZ DE CHARMOY (*Bul. Ent. Research*, 12 (1921), No. 2, pp. 184-190, fig. 1).—This is a discussion of the insect enemies of cotton, tobacco, maize, manioc, sweet potato, ambrevades, pois sabre, coconut, coffee, limes and other citrus fruits, mango, etc.

Some pests of cotton in North Bihar, C. S. MISRA (*Agr. Research Inst., Pusa, Bul. 108* (1921), pp. 547-561, pls. 6).—In this reprint from the proceedings previously noted (E. S. R., 45, p. 656), the species of importance given particular attention are *Pseudococcus corymbatus* Green, *Phenacoccus hisatus* Green, *Pseudococcus virgatus* Ckll., *Machaerota planitac*, *Saussetia nigra*, and *Eriophyes* sp. (possibly *E. possum*).

The important orchard insects of Idaho and their control, R. H. SMITH (*Idaho Sta. Circ.* 23 (1922), pp. 8).—Brief summaries are given of the more important insect enemies of the orchard in Idaho and means for their control.

Stored grain pests, T. B. FLETCHER and C. C. GHOSH (*Agr. Research Inst., Pusa, Bul. 111* (1921), pp. 712-758, pls. 26).—This reprint of a paper from the proceedings previously noted (E. S. R., 45, p. 657) includes the details of numerous experiments conducted by the authors.

Report on insecticides and fungicides, O. B. WINTER (*Jour. Assoc. Off. Agr. Chem.*, 4 (1921), No. 3, pp. 395-403).—This cooperative study of insecticides and fungicides, results of which are reported by the referee, deals respectively with Bordeaux-lead arsenate with Bordeaux-zinc arsenite, London purple, Paris green, and calcium and magnesium arsenates and zinc arsenite. Suggestions for future work and recommendations are included.

The rice leafhoppers, C. S. MISRA (*Agr. Research Inst., Pusa, Bul. 104* (1921), pp. 433-443, pl. 1).—This account, a reprint of the paper in the proceedings previously noted (E. S. R., 45, p. 656), deals with *Nephotettix bipunctatus* Fab. and *N. apicalis* Motsch., which were first reported as damaging rice in the Sambalpur District of Bihar and Orissa in 1910.

Control of the potato leafhopper, F. A. FENTON and A. HARTZELL (*Iowa Sta. Circ.* 77 (1922), pp. 4, figs. 5).—This circular furnishes information on the use of Bordeaux mixture and the method of application, including drawings which show the arrangement of the nozzle of the spray boom for early spraying when the potato vines are not full grown and for late spraying when the vines are about full grown.

Control of the leafhopper: Is it economically a hopeless problem in California? H. H. P. SEVERIN (*Facts About Sugar*, 14 (1922), Nos. 16, pp. 312, 313; 17, pp. 332, 333).—This is a report of work with *Eutettix tenella* Bak. conducted at the California Experiment Station in connection with the studies previously noted (E. S. R., 46, p. 854).

A synopsis of the genus *Stenocranus*, and a new species of *Mysidia* (Homoptera), H. L. DOZIER (*Ohio Jour. Sci.*, 22 (1922), No. 3, pp. 69–83, figs. 11).—The author recognizes 12 new species of *Stenocranus* occurring in the New World, of which 4 are described as new.

Some Indian economic Alecyrodidae, C. S. MISRA (*Agr. Research Inst., Pusa, Bul.* 103 (1921), pp. 418–433, pls. 8).—In this reprint from the proceedings previously noted (E. S. R., 45, p. 656), studies of *Alecyrodes barodensis* Mask., *Neomaskellia bergii* S. gn., and *Alecyrocanthus spiniferus* Quaint., the nature of their injury, notes on their life histories, habits, natural enemies, etc., are presented.

The control of the greenhouse white fly (*Asterochilton vaporariorum*), with notes on its biology, L. LLOYD (*Ann. Appl. Biol.*, 9 (1922), No. 1, pp. 1–32, pls. 2, figs. 7).—The author concludes that fumigation is the only effective measure of treating infested plants, and that cyaniding is the best method.

Mealybug on cacao, H. A. B[ALLOU] (*Agr. News [Barbados]*, 21 (1922), No. 518, p. 74).—A general widespread occurrence of mealybugs on cacao throughout the island of Grenada in 1921 and also on other food plants led to the investigation, a brief account of which is here given. A number of species were collected, of which three, namely, the citrus mealybug (*Pseudococcus citri* Risso), Broadway's mealybug (*Philephedra broadwayi* Ckll), and the pine-apple mealybug (*Pseudococcus bromeliæ* Bouché), were found on cacao.

Tukra disease of mulberry, C. S. MISRA (*Agr. Research Inst., Pusa, Bul.* 109 (1921), pp. 610–618, pl. 1).—This account of the injury to mulberry in Bengal, caused by the mealybug *Phenacoccus hirsutus* Green, is a reprint from the account previously noted (E. S. R., 45, p. 657).

Phylloxera and the reconstruction of vineyards, H. FAES, F. PORCHET, ET AL. ([Vaud] *Dept. Agr., Indus., et Com., Sta. Vitic. et Serv. Phylloxérique Rap.*, 1920, pp. 64).—This is the report of the viticultural station and of the phylloxera service on the work of the year 1920.

The Japanese camphor scale in Mississippi, G. F. ARNOLD (*Miss. State Plant Bd. Quart. Bul.*, 1 (1921), No. 3, pp. 1–4, figs. 2).—The author records the occurrence of *Pseudaulnidia duplex* at Hattiesburg, Jackson, and Pass Christian, Miss., this being the first known occurrence within the State. Its introduction appears to have taken place through nursery stock shipments from New Orleans.

Eradication of lice on pigeons, H. P. WOOD (*U. S. Dept. Agr., Dept. Circ.* 213 (1922), pp. 4).—The information here presented, which is based upon work conducted since the publication of the Farmers' Bulletin previously noted (E. S. R., 37, p. 357), describes the manner in which lice may be eradicated from a flock of pigeons.

In brief, it consists in (1) a thorough treatment with sodium fluorid by dipping and (2) a complete control of the pigeons after treatment. A bright

hot day in the middle of summer should be selected and treatment commenced early enough in the day so that the birds will be dry by sundown. Every pigeon and squab should be dipped in a solution consisting of commercial sodium fluorid 1 oz., laundry soap (hard) 0.75 to 1 oz., and water 1 gal. The body of each pigeon should be submerged in the solution until it is soaked to the skin, after which the head of the bird is ducked under, and it is then set free. In order to prevent reinfestation, no pigeon should be introduced into the flock without being dipped as above described, and precautions should be taken against stray pigeons getting into the flock.

A high degree of control may be obtained either by dusting with sodium fluorid with a dust can or by putting a pinch of sodium fluorid in several places on the bird. Dusting by any method should not be attempted if complete eradication is desired. This treatment was found to be effective against the two common species of pigeon lice, *Lipcurus baculus* N. and *Goniocotes compar* N., judging from examinations of a number of flocks, and there is no doubt that it will prove equally effective against any of the other six species known to occur on the domestic pigeon. The lice taken on pigeons have not been taken on sparrows, and these birds probably play an unimportant part as disseminators of pigeon lice.

Experiments in Egypt on the survival of the pink bollworms (resting stage larvae) in ripe damaged cotton bolls buried at different depths, F. C. WILLCOCKS (*Agr. Research Inst., Pusa, Bul. 107 (1921), pp. 532-546*).—This reprint of the account in the proceedings previously noted (E. S. R., 45, p. 657) reports the results of tests made in 1917.

Cotton bollworms in India, T. B. FLETCHER and C. S. MISRA (*Agr. Research Inst., Pusa, Bul. 105 (1921), pp. 443-470, pl. 1*).—This reprint from the proceedings previously noted (E. S. R., 45, p. 657) deals particularly with the species *Faras fabia* and *E. insulana* and the pink bollworm (*Gelechia gossypiella*), including considerable data on their infestation, etc., presented in tabular form.

The pink bollworm in Egypt, L. H. GOUGH (*Agr. Research Inst., Pusa, Bul. 106 (1921), pp. 472-532, pls. 13*).—This is a reprint from the proceedings previously noted (E. S. R., 45, 657), in which studies of *Gelechia gossypiella* in India during the years 1917 and 1918 are reported at length, much of the data being presented in tabular form.

The peach borer and methods of control, W. P. FLINT and S. C. CHANDLER (*Ill. Dept. Registr. and Ed., Div. Nat. Hist. Surrey, Ent. Ser. Circ. 8 (1922), pp. 11, figs. 7*).—A summary of information, in which an account is given of the paradichlorobenzene method.

Borers in sugar cane, rice, etc., T. B. FLETCHER and C. G. GHOSH (*Agr. Research Inst., Pusa, Bul. 102 (1921), pp. 354-417, pls. 50*).—This reprint from the proceedings previously noted (E. S. R., 45, p. 656) deals with the borer enemies of sugar cane, rice, etc., in India. A number of the more important pests and the nature of their work are illustrated in colors.

Moths' eggs under the microscope, A. E. TONGE (*Countryside Life [London], 51 (1922), No. 1318, pp. 463-467, figs. 39*).—Photomicrographs of the eggs of some 39 species of Lepidoptera, many of which are of economic importance, are reproduced.

Studies on Microsporidia, with special reference to those parasitic in mosquitoes, R. KUDO (*Jour. Morph., 35 (1921), No. 1, pp. 153-193, figs. 118*).—Three new species of Microsporidia obtained in the vicinity of Urbana, Ill., are described.

The first, *Thelohanina magna*, infests the adipose tissue of the larva of *Culex pipiens*. It is rare and is found in limited locality, and a heavy in-

festation appears to be fatal to the host. *T. illinoensis* infests the adipose tissue of the larva of *Anopheles punctipennis*, and is rarer than the first mentioned. The third species, *Nosema bactis* n. sp., attacks the adipose cells of the nymph of *Baetis* sp. and is more common than the other two. The possibility of using microsporidian parasites as one of the means of destroying mosquito larvae is suggested.

The paper includes a three-page bibliography.

On the botflies of the reindeer, A. M. BERGMANN (*Ent. Tidskr.*, 38 (1917), Nos. 1, pp. 1-32, pls. 5; 2, pp. 113-146, pls. 21; *abs. in Rev. Appl. Ent.*, 10 (1922), Ser. B, No. 2, pp. 40, 41).—The account of biological studies of *Oedemagena tarandi* L. and *Cephenomyia trompe* L. here presented includes technical descriptions of the adults and mature larvae. The larvae of *O. tarandi*, hatching from eggs attached to the hairs, enter the skin, and the warbles are found chiefly in the flanks and hind quarters. *C. trompe* is viviparous, the young larvae of the first stage being found in the nostrils and later penetrating the nasal sinuses.

The house fly as an agent in the transmission of the habronemas of equines, E. ROUBAUD and J. DESCAZEUX (*Bul. Soc. Path. Exot.*, 14 (1921), No. 8, pp. 471-506, pl. 1, figs. 9; *abs. in Trop. Vet. Bul.*, 10 (1922), No. 1, pp. 9-12).—An extended account is given of the life cycle and parasitism of *Habronema megastoma* Rud. in the house fly. The authors review the literature relating to the development of the parasites in flies and the manner of transmission, and report upon experimental work which they conducted. Recent investigations by Hill (*E. S. R.*, 43, p. 883) and by Bull (*E. S. R.*, 46, p. 181) have been noted.

Cherry fruit sawfly and its control, W. P. DUKVZ (*Better Fruit*, 16 (1922), No. 10, p. 7, 24, figs. 2).—This is a discussion of *Hoplocampa cokeri* Clark, which does considerable damage to cherries and plums in certain fruit districts of California. It occurs as far north as southern Oregon, where it has been found in the Rogue River Valley. The account is based upon a season's study of its biology and control.

Blackleaf 40 used in combination with either lime sulphur or miscible oil gave the best control. The contact insecticide applied at the time the blossoms were opening gave a satisfactory control. Arsenate of lead did not give satisfactory results. It is thought that the use of Nicodust should control the pest, and a test will be made of it during the present season.

Cabbage and radish root maggots, J. J. DAVIS (*Purdue Agr. Ext. Leaflet* 123 (1921), pp. 4, figs. 3).—Experiments conducted in 1921 on two farms in Lake County and one in Allen County, Ind., demonstrated in all cases the practicalness and effectiveness of the corrosive sublimate treatment for this pest. The results obtained are briefly reported.

"The solution used is prepared by dissolving in a glass or earthenware vessel 0.5 oz. of corrosive sublimate in a pint of hot water and then diluting to 5 gal. For larger or smaller amounts increase or decrease the amount of material and water accordingly. Five gal. will treat 200 or 300 plants at a cost of 5 to 10 cts. for material per application.

"For early cabbage apply soon after setting out or as soon as the small white eggs are observed at the base of plants and again about 12 days later, pouring about half a teacup at the base of each plant. It is not usually necessary to treat late cabbage transplants. Late cabbage in seed beds can be treated as for early cabbage transplanted, except pour long rows with a sprinkling can from which the rose has been removed or other vessel which will give a small stream.

"For radish, apply along the row as for the maggot in cabbage seed beds, using about 1 gal. to each 35 ft. of row. Usually one application is sufficient for radish, applying after the radishes are above the ground, preferably within a few days after the eggs are observed."

Control of the cabbage maggot, L. G. SCHIRMERHORN and C. H. NISSLEY (*New Jersey Stat. Circ.* 138 (1922), pp. 4, figs. 2).—In order to compare the relative efficiency of the three methods most commonly recommended for the control of the cabbage maggot, namely, (1) tar paper disks, (2) gas-house tar and sand, and (3) corrosive sublimate, demonstrations were conducted in five counties of the State and two tests made on the station grounds. The results show corrosive sublimate to be more efficient, more easily applied, and more economical than either of the other two. The average percentage of the stand killed by maggots in 1921 was for corrosive sublimate 1.96 per cent, tar paper pads 5.33, tar and sand 32.73, and check 58.53 per cent.

The root maggot of radishes, turnips, cabbage, and related vegetables, R. H. SMITH (*Idaho Sta. Circ.* 24 (1922), pp. 4, figs. 2).—This is a very brief summary of information.

Preliminary note on a toxin-producing anaerobe isolated from the larvae of *Lucilia caesar*, I. A. BENGTSON (*Pub. Health Rpts. [U. S.],* 37 (1922), No. 4, pp. 164-170).—Studies by the author of an anaerobe occurring in larvae of the green fly *L. caesar* have this far failed to show that it is etiologically related to humberneck in chickens. This organism produces a soluble toxin which in its effects on animals behaves in a manner similar to that of the toxin of *Bacillus botulinus*, but which fails to be neutralized by the antitoxins of either type A or B of *B. botulinus*.

The six-toothed bark borer of the spruce, *Pityogenes* (*Tomicus*) *chalcographus* L., and how to recognize it, R. S. MACDOT GALL (*Roy. Scot. Arbor. Soc. Trans.*, 34 (1920), pt. 2, pp. 167-171, pls. 2).—A brief account is given of this beetle in Great Britain and of other species that may be confused with it.

***Hyaleoetus* or *Lymexylon dermestoides* (L.)**, D. C. FERGUSON (*Roy. Scot. Arbor. Soc. Trans.*, 34 (1920), pt. 2, pp. 192-195, pls. 2).—This is a brief account of a beetle the larva of which was found at work in the stumps of lurch, spruce, Scots pine, and Spanish chestnut and in the logs of birch, beech, and gear at Balquhiddier and Dunkeld, Scotland.

A note on the larvae of *Anthrenus musacorum* L., its injury in the wool warehouses of Roubaix, P. DESOIL (*Compt. Rend. Soc. Biol. [Paris],* 85 (1921), No. 27, pp. 508-510).—This *Anthrenus*, which normally attacks museum collections and animal materials, is reported by the author to have attacked bobbins of wool and wool fabric in warehouses in which the invaders during the war had stabled their horses, harness, and other camp equipment. It attacked pure wool exclusively and never cotton or mixed fabric, preferring white rather than colored wool.

The destruction of stored grain by *Trogoderma khapra* Arr.: A new pest in Great Britain, F. A. MASON (*Bur. Bio-Technol., Leeds, Bul.* 2 (1921), pp. 27-38, figs. 5).—This is an account of a dermestid beetle of Indian origin which has become a source of great damage to stored malt placed in bins after leaving the kiln, even where the temperature never falls below 110° F. In control work, "It was found that the grubs suffered appreciably from the effects of chlorin at so great a dilution as 0.2 per cent by volume, and satisfactory evidence was obtained in favor of the use of this gas for the purpose of eradication. The actual method of attack decided upon included fumigation with chlorin gas, using liquid chlorin as a source, and treatment of the walls, floors, etc., with a hypochlorite solution containing 15 per cent available chlorin. The latter was

applied by means of spraying apparatus, which insured penetration of the liquid into all cracks and interstices likely to harbor the grubs, after which the rooves were sealed for a whole week." This treatment proved successful.

Further observations on *Sitones lineatus* L., D. J. JACKSON (*Ann. Appl. Biol.*, 9 (1922), No. 1, pp. 69-71, figs. 2).—This reports briefly upon further observations of the habits of *S. lineatus*. Together with peas and beans, alfalfa and tares form its favorite foods. Clover is attacked when they are not available.

The banana beetle borer (*Cosmopolites sordida* Chev.), J. L. FROGATT (*Queensland Agr. Jour.*, 17 (1922), No. 1, pp. 39-45, figs. 2).—This is a second progress report, of which the first has been noted (E. S. R., 46, p. 751).

The reputed vesicating properties of the granary weevil, *Calandra granaria* L., W. A. RILEY (*New Orleans Med. and Surg. Jour.*, 74 (1922), No. 10, pp. 678-682).—The author refers briefly to the literature and to experiments conducted, which clearly establish the fact that *C. granaria* has no vesicant properties.

Fortieth and forty-first annual reports of the Beekeepers' Association of the Province of Ontario, 1919 and 1920 (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpts.*, 1919, pp. 72; 1920, pp. 56).—The annual report of this association for 1919 (E. S. R., 42, p. 160) includes the following papers: Beekeeping in New Ontario, by W. Agar (pp. 22-25); Spraying and Its Relation to Bees, by L. Caesar (pp. 25-28); The Deep Hive, by C. E. Chrysler (pp. 28-30); The Production of Honey, by R. F. Holtermann (pp. 30-36); Feeding and Stimulative Feeding, by H. W. Jones (pp. 37-43); and Experimental Work in Beekeeping, by C. B. Gooderham (pp. 43-49).

The report for 1920 includes the following: Colony Morale, by G. S. Demuth (pp. 12-15); Apiary Morale, by M. Pettit (pp. 15-19); Factors Influencing the Spread of European Foulbrood, by E. F. Phillips (pp. 19-31); Diagnosis of American and European Foulbrood, by R. H. Kelty (pp. 31-37); Queen Rearing on Duck Island, by F. W. L. Sladen (pp. 39, 40), information relating to which has been previously noted (E. S. R., 41, pp. 856); Beekeeping Costs, by J. A. Byre (pp. 40-45); and Wintering, by E. F. Phillips (pp. 45-54).

The British Beekeeper's guidebook, T. W. COWAN (*London: D. J. Larby, Ltd.*, 1921, 24. ed., rev. and enl., pp. 111+226, pl. 1, figs. 158).—This is a small handbook.

Paratyphoid of the honeybee, L. BARK (*Meddel. K. Vet. og Landbohøjsk. Serumlab. No. 60* (1919), pp. 34).—Investigations of a very acute intestinal disease of the honeybee occurring near Copenhagen, Denmark, show it to be caused by a bacterium of the paratyphoid group, *Bacillus paratyphi alvei*, which apparently has not been previously described. It was introduced into the apiary through the purchase of infected bees and attacked eight or nine beehives in the colony, up to 50 per cent of the bees succumbing within a period of 8 to 14 days.

The disease is characterized by debility, paralysis, and sometimes diarrhea, the bees dying in from 24 hours to a few days. The organism was found to occur in great numbers in the feces of the bees attacked, often very nearly in pure culture, being isolated by cultivation on litmus-lactose agar. It was also found to occur in the blood of the infected bee, being motile, oval, Gram-negative, and not forming spores. Its cultural characteristics are described.

The studies show it to differ from the forms which occur in man and the domestic animals. The disease was easily produced in sound bees by feeding with small quantities of pure cultures of the bacterium deposited in a 5 per cent sugar solution. The wasp seemed likewise to be susceptible, but mice,

guinea pigs, and rats were immune. Certain bee colonies seem to be immune or only very slightly susceptible to the disease. While not, as a rule, isolated from the feces of sound bees, it has, however, occasionally been found therein. It is thought that cases of this affection may possibly have occurred and been overlooked under the names of "paralysis" and "dysentery" (diarrhea).

"The disease seems to be rather infectious and malignant and may be introduced into sound apiaries inter alia in the following ways: (1) By purchase of bees suffering from paratyphus and of apparently sound bees from an apiary which has been attacked by the disease some time before, (2) through infected drones (or bacillus carriers) from other bee colonies, (3) through examination by inspectors and others who carry the contagion with them from an apiary attacked by the disease, and (4) through infected frames, utensils, alvearies, etc. This and other bee diseases of an infectious nature should be combated especially by the following precautions: (1) The importation of bees and queen bees from abroad should be restricted or prohibited, and (2) the uncontrolled purchase and sale of bees should be limited as much as possible. To this end apiaries and queen bee breeding centers (preferably State controlled) should be established and be superintended by an expert bacteriologist and a capable and approved apiculturist so that beekeepers could buy sound bee colonies and queen bees from them."

The paratyphoid disease of the honeybee, H. RAEBIGER and E. WIDMER (*Deut. Tierarztl. Wchnschr.*, 29 (1921), No. 51, pp. 649, 650) --The authors record for the first time the occurrence in Germany of this affection of the honeybee, described by Bahr in Denmark in 1919 as caused by *Bacillus paratyphus alvei*, and the studies they made of it.

A contribution to the biology of *Bombus dahlbomii* Guér., P. HERBST (*Arch. Biencikunde*, 3 (1921), No. 3, pp. 33-36). The species here considered is said to be the only *Bombus* met with in Chile. It occurs throughout Chile from the desert in the Province of Atacama south to Tierra del Fuego, in the coastal as well as inland districts and into the mountains to an altitude of about 3,000 meters. The account includes a list of the blossoms visited by it at different seasons of the year.

The Argentine ant in Mississippi, R. W. HARNED (*Miss. State Plant Bd. Quart. Bul.*, 1 (1921), No. 2, pp. 1-6) --The Argentine ant has gradually spread through Mississippi until at the present time it occurs in at least 30 towns in 21 counties.

A new hymenopterous parasite upon adult beetles, A. B. GAHAN (*Ohio Jour. Sci.*, 22 (1922), No. 5, pp. 140-142).--A braconid parasite which attacks the cucumber beetle (*Diabrotica vittata*) at Marietta, Ohio, is described by the author as *Syrphidius diabroticae* n. sp. This parasite attacks the adult beetle by mounting on the back of its host and thrusting its ovipositor into the thorax, apparently through one of the sutures near the base of the elytra, and depositing its egg within. The parasite larva feeds internally and when mature escapes from the body of its host either at the junction of the head and thorax or of the thorax and abdomen, and although the host is not outwardly defaced, it is killed. The parasite larva undergoes its transformation just below the surface of the soil in a closely woven silken cocoon. Approximately 10 days are required for the pupation. It has been found in an average of 1 or 2 beetles per 100 late in the summer and somewhat more commonly in May and June.

Introduction of the woolly apple aphid parasite *Aphelinus mali* Hald. into France, P. MARCHAL (*Compt. Rend. Acad. Agr. France*, 7 (1921), No. 28, pp. 619-625).--An account of the introduction of this parasite from the United

States and its establishment in France, reference to which work has been noted from another source (E. S. R., 46, p. 560).

A new parasite of the elm leaf-beetle, *Degeeria collaris* Fall., W. R. THOMPSON (*Bul. Soc. Ent. France*, No. 10 (1920), pp. 180-184, pl. 1, figs. 4).—In addition to the chalcid egg parasite *Tetrastichus xanthomelaenae* Rond. and the tachinid *Erynnia nitida* Rond., an endophagous parasite of the larva and adult the author records the rearing of the tachinid *D. collaris* from adult elm leaf-beetles received from Bevogna, in Umbria, Italy. Since these parasites were obtained from adults collected in the spring, probably toward the end of April, it is thought probable that the larvae of the parasite, as in the case of *E. nitida*, overwinter in the body of the host.

On the biology of a chalcid, J. L. LICHTENSTEIN (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 17, pp. 733-735, fig. 1).—The author, in reporting upon observations at Montpellier, records the parasitism of the cocoons of the weevil *Cionus thapsi* by the chalcid *Habrocytus cionicida* n. sp. A single egg is deposited on a weevil larva, and hatches in 2 or 3 days. The larva feeds for 7 to 8 days and then pupates within a period of 2 days within the cocoon of the host, the adults emerging about 2 weeks later.

The oviposition of the chalcid *Habrocytus cionicida* Licht., J. L. LICHTENSTEIN (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1416, 1417).—This is an account of the oviposition of *H. cionicida* in *Cionus thapsi*, studies of which parasite are noted above.

The red spider of the avocado, G. F. MOZNETTE (*Fla. Grower*, 25 (1922), No. 13, pp. 5, 6, 26, figs. 4). This popular account is based upon investigations previously noted (E. S. R., 46, p. 752).

FOODS—HUMAN NUTRITION.

The book of bread, O. SIMMONS (London: MacLaren & Sons [1921], [2. ed.], pp. [326], pls. 22, figs 5).—This is an elaborate treatise on bread making with many photographic illustrations, some in colors, representing the best examples of different types of English and Scotch bread. The subject matter consists of information on the various ingredients used in bread making; the good and bad points in a loaf of bread and how they should be obtained and avoided; changes in flour and bread during storage, fermentation, baking, and digestion; the finishing of the dough to obtain loaves of symmetrical shape; the necessary machinery for bread making; and methods of fermentation and manufacture. The last-named section contains tables of methods and recipes employed in bakeries in different sections of England and in other countries, with information as to the quality of the bread thus produced. A final section contains data on the equivalents of the various English measures of weight and volume.

Loss of carbon dioxide from dough as an index of flour strength, C. H. BAILEY and M. WEIGLEY (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 2, pp. 147-150, figs. 4).—A procedure is described by means of which the retention of carbon dioxide in dough during the period before baking can be measured from a comparison of the total CO₂ evolved by the dough when allowed to stand under the prescribed conditions until it finally falls or flattens, and the increase in volume of the dough under prebaking conditions. When tested in this way weak flours were found to lose much more carbon dioxide than strong flours. It is concluded that a part of the carbon dioxide produced at the outset becomes dissolved in the dough without causing an appreciable expansion of the dough, and that the "ripening" of the dough is in part related to the progressive

solution of carbon dioxide in the dough which may later become available for expanding the loaf when the latter is placed in the oven to bake.

California sardine food products and their preparation, H. R. BEARD (*Calif. Fish and Game*, 7 (1921), No. 4, pp. 238-247, figs. 6).—A descriptive article giving data regarding the packing and processing of California sardines and related information, including the fuel value per pound of California sardines in comparison with some other foods.

The cause of peas remaining hard on cooking, J. P. VAN DER MAREL (*Pharm. Weekbl.*, 59 (1922), No. 4, pp. 82-91).—To determine the cause of the failure of peas to soften on cooking, equal amounts were boiled for 1½ hours in distilled water and in water containing various salts, acids, and bases in M/10 to M/100 concentration, and at the end of the time the percentage remaining hard was determined. It was found in general that acids and neutral salts hinder the softening of peas, salts of alkali metals to a less extent than those of divalent or trivalent metals, and that salts with an alkaline reaction and hydroxids of the alkali metals hasten the softening. With whole seeds the softening was proportional to the moisture content of the seeds. It is considered that any treatment which renders pectins soluble hastens the softening of the peas.

Some precautions in canning process, II, W. D. BIGELOW (*Amer. Food Jour.*, 17 (1922), No. 4, pp. 11, 12).—This paper on the canning of peas continues the discussion previously noted (E. S. R., 46, p. 754).

It is recommended that No. 2 cans be processed for 40 minutes at 240° C. or for 15 minutes at 250°. In this connection it is noted that in processing peas in any size of can at the temperature of 240° an error of 1° in temperature makes a difference of 6 minutes in the time necessary to sterilize.

Among the points brought out in suggestions as to causes of low quality in canned peas, the following may be of interest to the home canner: The use of too mature peas, mixing of immature with mature, and delay in canning after picking the peas will give an inferior product. It is emphasized that blanching has no value in softening the peas, its purpose being only to wash them. The blanch should, therefore, be no longer than necessary to wash the peas and insure a relatively clear liquor. Hard water, both in blanching and processing, tends to toughen the peas. The highest quality products can only be secured with water that is relatively soft. Similarly the use of an unnecessarily large amount of salt increases the hardness of the peas. Judgment and care should be used in processing. The larger and harder the peas the longer should be the processing period.

Use of pectin in jams and jellies, H. S. PAINE (*Amer. Food Jour.*, 17 (1922), No. 3, pp. 11-13).—The author, from the Bureau of Chemistry, U. S. D. A., discusses the nature and properties of pectin and outlines several unsolved problems in connection with the use of pectin in jelly making, including the question as to whether the conditions of temperature, proportion of water, acidity, time of heating, and subsequent treatment which are most suitable for the extraction of pectin are also suitable for the extraction of color and flavor; the question of the effect of varying proportions of invert sugar in jellies and jams; the problem of the clarification of fruit juices; and the question of calculating the proportions of ingredients to be used to reduce as far as possible the time of heating required.

Attention is called to the fact that the alcohol test for pectin may not give concordant results when applied to different fruits on account of the fact that other substances than pectin may be precipitated. It is also suggested that there may be qualitative as well as quantitative differences in the pectin present in different fruits.

Dehydration and the preservation of foods, H. W. YOUNGKEN (*Sci. Mo.*, 14 (1922), No. 4, pp. 332-344).—A popular discussion of methods of preserving foods, particularly the present methods of dehydration.

Physical examination of food handlers, L. B. GLOYNE (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 19, pp. 1455, 1456).—This brief discussion of the importance of physical examination of food handlers is based on the author's experience in the enforcement of an ordinance requiring such an examination of food handlers in Kansas City, Kans.

A study of the nutrition and economic conditions of working-class families in Glasgow in April, 1921, A. M. T. TULLY (*Lancet [London]*, 1921, 11, No. 1, pp. 57-59). This is a continuation of the series of dietary studies by Ferguson previously noted (*E. S. R.*, 42, p. 863). The families selected for this study were 11 typical laboring class families in Glasgow, including 68 persons--12 men, 11 women, 34 children under 10, and 11 children over 10 years of age. The study was made during a period in which there was a general strike of coal miners and the fathers were either out of work or on short time.

The energy value of the diets per man per day varied from 1,610 to 3,414 gross calories, the value being over 3,000 in only 2 of the 11 families. It is of significance that in these 2 cases and in 2 others considerably more than the entire available income was spent for food, the extra amount being secured by borrowing or by selling or pawning the family belongings. Most of the families lived in poor overcrowded quarters. The effect of the undernutrition is shown by a comparison of the weights of the children with the British anthropometric standards. The average deficiency in weight for all the children was 15.9 per cent.

In an introductory note by N. Paton attention is called to the fact that in 3 of the families the conditions were worse than in the majority of the families in Vienna previously studied by Gibbon and Ferguson (*E. S. R.*, 45, p. 562), the energy value in these 3 cases reaching the low limits of 1,610, 1,660, and 1,775 gross calories per man per day.

Some new observations and interpretations with reference to transportation, retention, and excretion of carbohydrates, O. FOHN and H. BERGUND (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 213-273).—This paper, which should be consulted in the original for the discussion and interpretation of the literature on the subject and of the experimental data reported, deals mainly with the rise and fall of sugar in the blood and urine following the intake of glucose and other carbohydrates. The more important conclusions drawn from the study are as follows:

Glucose, while being more effective than other carbohydrates in raising the level of the blood sugar, does not, in amounts up to 200 gm., except in cases of emotional complications or a subnormal renal threshold, raise the level of the blood sugar above the threshold in normal persons. The excess sugar is thought to be taken care of by absorption from the blood by the tissues rather than through the formation of glycogen. A renal threshold similar to that for glucose is considered to exist for fructose but not for lactose or galactose. The retention and utilization of galactose is considered to depend upon the amount of available glucose. This is thought to furnish an explanation of the value of lactose to the young. The hydrolysis of lactose furnishes galactose which is needed for the building of nerve tissue, and the surplus galactose is readily utilized because of the presence of glucose. It is suggested that for infants whose growth is subnormal or whose urine contains sugar less lactose and some pure glucose may be better than lactose alone in milk formulas. It

is also suggested that galactose rather than milk may be advantageous for nursing mothers whose milk is low in lactose.

It is pointed out that hypoglycemia (subfasting blood sugar level) is quite as normal a consequence of carbohydrate ingestion as hyperglycemia but comes later. This condition of hypoglycemia is obtained when there is an abundance of available carbohydrate material or even of fat in the tissues.

Definite glycosuria, the term suggested by Benedict for increase of sugar in the urine (E. S. R., 39, p. 875), was found to occur after every ordinary carbohydrate meal, but to be independent of the level of the blood sugar and not to be normally obtained from the ingestion of pure glucose, maltose, dextrin, or starch. Glycosuria is thought to represent the absorption and excretion of foreign unusable carbohydrate material in grains, vegetables, and fruits, and of decomposition products due to cooking such food.

The blood sugar was found to be distributed in somewhat varying proportions between the plasma and corpuscles. That of the plasma is usually diminished and that of the corpuscles increased by hydrolysis, thus indicating that the corpuscles probably contain polysaccharids.

Duodenal regurgitation into the stomach during gastric digestion, C. BOLTON and G. W. GOODHART (*Lancet* [London], 1922, 1, No. 9, pp. 420-425, figs. 12).—Using the Rehfuess fractional extraction tube and a gruel test meal, the authors have made a complete analysis of the gastric contents obtained at 15-minute intervals on a number of normal subjects and on others suffering from various gastric disturbances. Curves of the total and inorganic chlorids and active HCl illustrating various cases are given and discussed. The slopes of these curves are thought to indicate that duodenal regurgitation occurs at a definite period, but not always at the same time during gastric digestion. Regurgitation causes the curve of HCl to fall rapidly and of the inorganic chlorids to rise. The two principal factors contributing to the form of these curves are considered to be the varying degrees of pyloric relaxation occurring at varying times and hypersecretion.

The H-ion concentration of the intestinal contents, S. OKADA and M. ARAI (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 135-139).—Data are reported on the H-ion concentration as determined electrometrically of the duodenal contents of 15 hospital patients and of 5 dogs. Of 11 cases examined fasting, the duodenal contents were alkaline in 8 and acid in 3 cases, the pH values varying from 7.9 to 6.59. Of 12 cases examined after the intake of food, 7 were acid, 4 alkaline, and 1 neutral, the pH values varying from 4.8 to 7.97. No special relation appeared to exist between the acidity of the stomach and the reaction of the duodenal contents.

The reaction of the duodenal contents of 3 dogs was alkaline and of 1 acid. The reaction of the ileal contents was acid in 1 case and alkaline in another.

Effect of severe muscular work on composition of the urine, J. A. CAMPBELL and T. A. WEBSTER (*Biochem. Jour.*, 16 (1922), No. 1, pp. 106-110).—This investigation supplements one previously noted (E. S. R., 47, p. 64), the same subject increasing his work on a bicycle ergometer to 20,000 kpm. per hour for 5 hours, a 3-hour period in the morning and a 2-hour period in the afternoon. The experimental periods continued for 5 days. On the first day the subject was unable to continue the work after the third hour, on the second day he was able to do more, and in the remaining days the full amount of work was completed in 5 hours.

The same differences between the composition of the day and night urine as those reported in the previous study were obtained. The severe and unaccustomed work resulted in symptoms of muscular strain and pathological changes

in the composition of the urine. Creatinin, undetermined nitrogen, neutral sulphur, and lactic acid were greatly increased, and acetone bodies were present during part of the experiment.

Carotinoid pigmentation of the skin resulting from a vegetarian diet, H. HASHIMOTO (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 15, pp. 1111, 1112).—Attention is called to several instances in Japanese literature in which has been noted a yellow pigmentation of the skin developing as the result of eating various vegetables and mikan, a kind of orange grown in Japan. In the author's experience more than 35 cases have been observed of yellow coloration of the skin after the eating of unusual amounts of squash (*Cucurbita maxima*). It is said that the condition may be easily differentiated from jaundice by the localization of the discoloration, which is most evident in the palms of the hands, soles of the feet, and forearms. The discoloration is principally in the horny layers of the epidermis.

"It is evident that in the cells of the horny layer of the human epidermis there exist certain kinds of fat that are colored by fat staining dyes slowly but steadily, and once colored, maintain the color for a long while. In the case of carotinoid pigmentation of the skin it is highly probable that such kinds of fat present in the epidermis are colored by the carotinoids which are excreted by the skin secretions."

The sources of vitamins (*Brit. Med. Jour.*, No. 3186 (1922), pp. 112, 113).—An editorial summary of the literature on the probable synthesis of vitamins.

The destruction of vitamins (*Brit. Med. Jour.*, No. 3189 (1922), pp. 236, 237).—In this editorial discussion emphasis is placed on the superior value of fresh foods v. medicinal preparations and manufactured products as sources of vitamins.

Experimental investigations on the influence of vitamins on digestion and metabolism and the theory of vitamin action, A. BICKER (*Klin. Wchnschr.*, 1 (1922), No. 3, pp. 110-112).—The author reports briefly the results of various studies which have been conducted by different workers in his laboratory in an effort to determine the nature of vitamin action.

Experiments conducted by K. Miyadera on a dog with a Pawlow blind sac have shown that on a vitamin free ration of polished rice, pure wheat protein, salt, and lard there is no secretion of gastric juice. That the gastrointestinal canal has not lost its power of secreting digestive juices is shown by renewed secretion on the same diet with the addition of a water solution of alcohol.

To determine whether such a vitamin-free food mixture is capable of being resorbed in the intestines, M. Tsuji and A. Loewry conducted metabolism experiments on a dog weighing 11 kg. at the beginning of the experiment. The vitamin-containing ration of the fore-period consisted of 50 gm. dried horse meat, 25 gm. of butter, 50 gm. of polished rice, 3 gm. of salt, and 700 cc. of water. In the vitamin-free period the ration consisted of 44 gm. wheat protein, 20 gm. lard, 60 gm. of polished rice, 3 gm. of salt, and 700 cc. of water. In the 20-day fore-period there was a daily average of 5.4 gm. of dry feces with 0.18883 gm. nitrogen, and in the main period of 107 days a daily average of 4.9 gm. dry feces with 0.1128 gm. nitrogen. This is thought to indicate that on a vitamin-free diet, in spite of the lack of stimulation of gastric juice, the breaking down of the food material and resorption from the intestinal walls is not interfered with.

Daily determinations of the nitrogen balance during this experiment showed that nitrogen equilibrium was maintained until the fifty-second day of the experiment, during which time, however, the animal lost 2 kg. of its body weight. From the fifty-second to the sixty-ninth day there was an increasing negative

nitrogen balance, which then became smaller and finally came to equilibrium just before the death of the animal on the one hundred and seventh day, at which time there had been a total loss of weight of 3.9 kg. From the nitrogen determinations it is calculated that about 900 gm. of this loss in weight is due to protein, the remaining 3 kg. being due to the burning of fat and carbohydrate. This would imply increased oxidation, but on the contrary a lowered oxygen consumption was found to be the case during the final period. The explanation of this apparent anomaly is thought to be the failure of the body cells to utilize the catabolized food materials, with a consequent breaking down of the tissues.

Further experiments by Miyadera are also noted in which the calcium balance of a dog was determined in successive periods of feeding a vitamin-poor and vitamin-rich ration with varying amounts of calcium salts. The presence of vitamins was found to augment greatly the calcium retention. This is thought to give further evidence that the essential function of vitamins is to enable the body cells to assimilate and utilize digested food materials.

Water-soluble B and bios in yeast growth. E. I. FULMER and V. E. NELSON (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 77-81).—Data are presented which are considered to verify the authors' previous conclusions (E. S. R., 45, p. 565) that 90 per cent alcoholic extract of alfalfa does not improve the synthetic medium F found favorable for the growth of yeast. This work was repeated on account of a statement in the paper by Eddy et al. (E. S. R., 46, p. 164) to the effect that this medium can be stimulated by the alfalfa extract. In explanation of these contradictory claims, the authors call attention to two points of difference in the methods employed, namely, that in the technique of Eddy the temperature varied from 30 to 35° C. instead of being kept at the optimum of 30°, and that water extracts were used instead of alcohol extracts. Repeating the work, using the water extract prepared according to Eddy, the growth of yeast in the synthetic medium was stimulated. The conclusions drawn are that the water extract contains both vitamin B and bios, the yeast growth stimulant, while the 95 per cent alcoholic extract contains vitamin B but not bios.

Yeast preparations and vitamin B concentrates. W. A. PUCKNER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 15, p. 1146).—In connection with the question of listing yeast preparations and vitamin B concentrates in New and Non-official Remedies, the Council on Pharmacy and Chemistry of the American Medical Association has issued the following statement:

"The claim that deficiency of vitamin B and diseases resulting therefrom are common conditions in the United States is not at this time supported by adequate acceptable evidence.

"The claim that yeast preparations or extracts are, in principle or in general, essentially more effective or more practical or more available means of administering vitamins than the commonly available vitamin-containing foods is not at this time supported by adequate acceptable evidence.

"The claim that therapy with yeast or yeast preparations has as yet more than an experimental status is not at this time supported by adequate acceptable evidence."

The therapeutic use of yeast and vitamin preparations (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 15, p. 1127).—This is an editorial comment on the above, giving further emphasis to the belief that the best source of vitamins is a well-selected diet.

"No one will deny the great contribution which the discovery of the vitamins has made to physiology and medical progress. It shares with the current conceptions of food energy in adding helpful ideas to the science of nutrition both

in health and in disease. There is no reason, however, to seek calories in tablets. Why shall vitamin B be sought by every family on the druggist's shelves rather than in the garden or the grocery, the dairy, or the meat market?"

The comparative antiscorbutic values of milk, J. M. JOHNSON and C. W. HOOPER (*Pub. Health Rpts. [U. S.], 37 (1922), No. 17, pp. 989-1020, figs. 15*).—This study of the comparative antiscorbutic value of milk and milk powders was conducted on guinea pigs, which received in general a basal ration of hay and oats ad libitum, the milk to be tested being given in place of water to drink. The amount of milk taken each day was measured, the animals were examined two or three times weekly for scurvy, and the clinical symptoms were confirmed by histological findings on autopsy. The varieties of milk tested included a fresh raw milk from cows kept on a silage feed, certified milk from cows fed grain and silage in winter and green feed in season, milk pasteurized at 145° F. from cows fed upon silage and grain in winter and pastured during the summer, a reconstructed milk made from spray process skim-milk powder with the necessary butter and water, whole-milk powder made by the spray process and diluted with water to the original or a more concentrated condition, a brand of roller-process milk powder made especially for babies, a roller-process whole-milk powder, and a roller-process skim-milk powder, all made up with water to the original concentration of the fluid milk.

Representative charts are given of the growth curves of individual animals on the different kinds of milk and composite charts obtained from the average weights of all the guinea pigs on each kind of milk. These composite charts show that a fair increase in growth was obtained with only two milks, the raw milk and the milk made from the roller process milk powder especially for babies. Whole-milk powder and skim-milk powder made by the roller process gave no better growth than the spray-process milk powders or the pasteurized milk. The certified milk did not give as good results as the other sample of raw milk. This is attributed partly to the fact that the certified milk was older than the other raw milk.

Scurvy developed in some animals on all the diets. Of 5 animals on the raw milk only 1 developed scurvy, while 4 out of 5 developed it on the certified milk. Of 6 animals on the special milk powder all but 1 developed scurvy, but the cases were all mild. On the other samples all developed scurvy.

The authors conclude that no milk is trustworthy to prevent scurvy when the animal is not forced to consume large amounts daily, and that an active antiscorbutic material like orange juice must be added to the diet of infants to prevent the occurrence of scurvy.

Further observations on the distribution of vitamin B in some vegetable foods, T. B. OSBORNE and L. B. MENDEL (*Jour. Amer. Med. Assoc., 78 (1922), No. 15, pp. 1121, 1122, fig. 1*).—The earlier work on the distribution of vitamin B in plant products (*E. S. R., 43, p. 765*) has been extended to asparagus, celery, dandelion, lettuce, and parsley. The vegetable products were prepared by drying the well-cleaned, finely-divided, uncooked edible parts in a current of air at about 80° C. Of the celery only the blanched stalks were used and of the asparagus the upper 5 in. portions of freshly gathered shoots. The vegetables thus dried were fed apart from the basal vitamin B-free ration in tablets containing varying weights of the vegetable in question.

Asparagus proved to be very rich in vitamin B, the minimum daily dose approximating 200 mg. of the dry material, equivalent to 2.2 gm. of the fresh vegetable. Of the celery, the amount required daily ranged from 500 to 800 mg., equivalent to 10.8 and 17.2 gm., respectively, of the fresh stalks. Of the lettuce

400 mg. of the dried or 11 gm. of the fresh plant proved sufficient. Dandelion leaves contained very little vitamin B, as shown by the fact that doses less than 400 mg. (equal to 5.6 gm. fresh leaves) failed to promote any gains in weight, and even with 600 mg. daily nutritive failure ultimately ensued. With parsley 200 mg. (2.7 gm. fresh material) proved insufficient to promote growth, but 400 mg. proved sufficient to promote considerable growth.

In comparison with apples, pears, and grape juice the asparagus, celery, and lettuce proved more potent in vitamin B. "What variations in potency, such as we have found to exist between different lots of grasses harvested at unlike stages of ripeness might be found on elaborate investigation of large numbers of samples of green vegetables differing in cultural variety and in their stage of maturity can not be foretold. The foregoing evidence, however, gives added justification for the nutritive prominence of the vegetable products examined, and serves in part to emphasize their importance in the diet of man."

The antiscorbutic property of fruits.—II. An experimental study of apples and bananas, M. H. GIVENS, H. B. McCULLAGE, and E. G. VAN HORNE (*Amer Jour. Diseases Children*, 23 (1922), No. 3, pp. 210-225, figs. 13).—This is the complete report of an investigation previously noted from a preliminary report (E. S. R., 45, p. 466), the work being a continuation of the series of studies previously noted (E. S. R., 43, p. 765).

In addition to the data presented in the preliminary report, evidence is given that apples dried at from 35 to 40° C. contain less vitamin C than those dried at from 55 to 60°. The greater destruction of the vitamin in the former instance is attributed to the longer period of heating necessary for drying at the lower temperature.

Bananas cooked for 15 minutes at 100° in dilute citric acid afforded greater protection against scurvy than when heated at the same temperature and for the same length of time in water. Dried apple peelings were richer in vitamin C than dried peeled apples. It is suggested that this may be due either to a greater association of the vitamin with the cells in the peelings or to the protection afforded by the cellulose covering of the apple against destruction by the heat of dehydration.

The nature of the paralysis of nerve in the birds of beriberi-like disease. G. KATO, S. SHIZUME, and R. MAKI (*Japan Med. World*, 1 (1921), No. 3, pp. 15-19, figs. 2).—Essentially noted from another source (E. S. R., 46, p. 669).

Beriberi-like disease in mammalian animals. S. OSEKI (*Japan Med. World*, 1 (1921), No. 3, pp. 6-11, figs. 3). This is a continuation of the studies on vitamin B previously noted (E. S. R., 46, p. 668).

It is first noted that mice when fed on polished rice alone or with Osborne and Mendel's salt mixture increase in body weight for a few days and then lose their appetite, refuse to eat, and lose weight. If vitamin B is then added the animals again gain in weight for a few days, after which there is a second loss in weight. On the addition of suitable protein such as lactalbumin, casein, etc., the body weight again increases for a time. This is followed again by loss in weight, accompanied in many cases by ophthalmia which can be cured by the administration of liver oil. In the author's experience this is not followed by a gain in weight, this occurring only on the administration of vitamin C. It is concluded that the difference in rapidity of reaction due to the deficit of each food constituent depends upon its storage in the body and functional necessity in metabolism.

In the next part attempts to isolate vitamin B are reported briefly. The activity of rice bran was found not to be destroyed by heating for 12 hours

with up to 30 per cent sulphuric acid. A scheme of attempted isolation of vitamin B from the hydrolysis products of rice bran is outlined. A gold salt was finally obtained which proved active, but on further recrystallization lost its activity.

Determinations of the water content, nitrogen balance, fat content, and liver glycogen content of mice fed polished rice and salt mixture, with and without vitamin B, have led to the conclusion that all these constituents are increased on the vitamin-containing diet, and that "the increase of the body weight of animals with addition of vitamin B is due not only to the increase of appetite but also promotion of assimilation of nutritive elements."

To determine the quantitative relation of beriberi-like symptoms to vitamin B, varying amounts of an extract of vitamin B were given to pigeons with spastic rigidity of the neck as the result of a polished rice diet. The order in which recovery took place showed that the symptoms progress from peripheral to central regions and are removed in the reverse order. When some but an insufficient amount of vitamin B is fed the birds do not lose weight, but develop paralysis of the legs. To determine the amount of vitamin B in the bodies of pigeons under normal conditions, when no vitamin B has been fed, and when an insufficient amount has been given, alcoholic extracts of the macerated bodies of such pigeons, after the beaks and feathers had been removed and the fat extracted with ether, were given as the source of vitamin B to pigeons which had begun to lose weight on a polished rice diet. The order in which the pigeons developed symptoms of polyneuritis was (1) those receiving no addition to the polished rice and salt ration, (2) those fed extracts of pigeons which had received no vitamin B, (3) those fed extracts of pigeons which had received an insufficient amount of vitamin B, and (4) those fed extracts of normal pigeons. This would seem to indicate a slight storage of vitamin B in the body.

In conclusion the author states that the essential difference between human beriberi and avian polyneuritis is that the former is a hypovitaminosis and the latter an avitaminosis, i. e., the former is the result of an insufficiency and the latter a complete lack of vitamin B.

The relation of diet to pellagra, J. GOLDBERGER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 22, pp. 1676-1680).—In this paper, read before the Congress of American Physicians and Surgeons in Washington, D. C., on May 3, 1922, the author reviews from the literature the evidence bearing on the relation which diet plays in the treatment, prevention, and causation of pellagra. The conclusions drawn are essentially those reported in a recent paper by Goldberger and Tanner (*E. S. R.*, 47, p. 65) that "the dominating rôle of diet in the development of the disease would seem referable to a specific quality of the amino acid make-up of the protein supply."

Treatment and prevention of pellagra by a daily supplemental meal, G. A. WHEELER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 13, pp. 955-957).—In connection with the investigations on pellagra conducted by the U. S. Public Health Service at the Pellagra Hospital, Spartansburg, S. C., an out-patient clinic was treated solely by daily supplemental meals consisting of fresh meat, vegetables, sweet milk or buttermilk, wheat or corn bread, butter and a dessert, generally fruit. The patients were for the most part cotton mill operators living near the hospital and continued their usual occupation, the cases all being ambulant of a moderate degree of severity.

Of 54 definite cases of pellagra thus treated, all recovered from the eruption and all but one from other symptoms within a few weeks of admission to the

clinic. There was no evidence of recurrence of the disease while continuing this supplemental meal, although in most cases there had been regular consecutive annual recurrences before beginning the treatment. Within from 5 to 8 months after discharge from treatment 7 of the patients developed recurrent attacks.

Newer aspects of the rickets problem, A. F. HESS (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 16, pp. 1177-1183).—In this lecture, delivered at the Harvard Medical School on February 15, 1922, the author discusses the etiology of rickets, particularly from the standpoints of the rôle in the diet of vitamin A, the rôle of phosphorus, and the significance of light in controlling rickets. Evidence from clinical and laboratory investigations, most of which have been noted from their original sources, is reported from which the conclusion is drawn that although vitamin A, or a vitamin closely associated with it, may play a rôle in the etiology of rickets it does not play a dominant rôle. Phosphorus is an important factor in infantile rickets as well as in that of laboratory animals, but until the factors influencing the absorption and retention of phosphorus are known it will be impossible to judge the exact rôle played by this element. It is emphasized that "the phosphorus requirement of a growing individual is labile, that a supply which is adequate may shortly become inadequate, or, on the other hand, that a supply which is inadequate may be rendered adequate simply by a diminished rate of growth."

The influence of light on rickets is shown to differ according to the diet, the rate of growth, and the degree of skin pigmentation. The latter point is illustrated by a single experiment in which black rats when given the minimum protective dose of light in connection with a rickets-producing diet contracted rickets, while white rats under the same conditions did not. The greater susceptibility of colored than of white children to rickets is thought to be due to skin pigmentation rather than to any racial predisposition.

Experimental rickets, E. MELLANBY (*[Brit.] Med. Research Council, Spec. Rpt. Ser., No. 61 (1921), pp. 78, pls. 46*).—This is the detailed report of an extensive investigation of the cause of rickets, using puppies as experimental animals. A preliminary report, giving in brief many of the conclusions set forth in greater detail in this publication, has been noted previously (*E. S. R.*, 41, p. 364).

A general discussion of the methods of examination for rickets and a brief description of the earlier experiments are first given. This is followed by the report of a systematic study of the effect of various constituents of the diet on the production of rickets, of the relative importance of exercise as compared with diet in preventing the disease, and of the effect of increased metabolism and of infection in influencing its course, and a brief description of other defects which develop in puppies on rickets-producing diets. An extensive series of radiographs and photographs illustrating different features of the investigation is appended.

In the general discussion of the results of this investigation, the author summarizes the conditions tending to prevent rickets in puppies as "plenty of calcium and phosphorus in the diet, something associated with certain fats probably identical with the fat-soluble vitamin, meat, and the possibility of exercise." The conditions inhibiting calcification of the bones resulting in rickets are summarized as a "deficiency of calcium and phosphorus in the diet; a deficiency of fat containing the antirachitic vitamin; excess of bread, other cereals, and carbohydrates; excess of the protein moiety of caseinogen free from calcium; and confinement."

The vitamin theory in rickets (*Brit. Med. Jour.*, No. 3184 (1922), pp. 20, 21).—A brief review is given of the above-noted report of Mellanby, together with a summary of results of other investigations in regard to the etiology of rickets.

A further report on the prevention of rickets in rats by light rays, A. F. HESS, L. J. UNGER, and A. M. PAPPENHEIMER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 5, pp. 238, 239).—This paper gives the experimental data of the observations on the effect of pigmentation upon the curative action of light for rickets previously noted (*E. S. R.*, 47, p. 66). It is also noted that prolonged exposure to direct sunlight failed to prevent or delay the onset of scurvy in guinea pigs.

Botulism, L. BITTER (*Ergeb. Allg. Path. Mensch. u. Tiere*, 19 (1921), pt. 2, pp. 733-800).—The author traces the history of botulism in Germany, and discusses the chemical and pathological-anatomical symptoms of the disease, the frequency of its occurrence, the food involved in the cases reported, the cultural characteristics of *Bacillus botulinus* and methods for its isolation, the properties of botulinus toxin and the effect of the toxin on different laboratory animals, and attempted methods of immunization against the disease.

Of 68 outbreaks reported, 11 were traced to fish or fish products, 16 to sausage, 9 to meats other than smoked meats, 18 to smoked meat, 1 to canned beans, and 13 to other miscellaneous foods. The percentage mortality for the various groups varied from 6.5 in the case of meats other than sausage or smoked meat to 52.3 per cent in the case of canned beans. A list of 102 references to the literature, mostly from German sources, is appended.

The pathogenicity of *Bacillus botulinus*, P. F. ORR (*Jour. Infect. Diseases*, 30 (1922), No. 1, pp. 118-127).—The author's investigations have led to the following conclusions:

"The optimum temperature for growth and elaboration of toxin by *B. botulinus* is that of the body temperature, 37° C. *B. botulinus* can be recovered from the internal organs of animals which have been fed or injected with toxic cultures and also with toxin-free spores of this organism. *B. botulinus*, under certain conditions, will grow and produce toxin in the body of the guinea pig. Experimental botulism can be produced in laboratory animals by the feeding or injection of massive quantities of toxin-free spores of *B. botulinus*. The presence of toxin produced in the body as a result of growth of toxin-free spores in the body can be demonstrated by the precipitin test as well as by direct toxicity tests. Botulism poisoning in man due to the ingestion of spores is probably very rare, if it occurs at all. The possibility of such occurrence must, however, be considered."

ANIMAL PRODUCTION.

The relation of the size of a ration to its digestibility, F. HONCAMP and E. KOCH (*Landw. Vers. Sta.*, 96 (1920), No. 1-2, pp. 45-120).—The authors review previous work in this field, which has been somewhat contradictory as a whole, and report the results of four experiments with wethers on the digestibility of large and small rations. Each experiment was divided into feeding periods of 10 days each, between each of which there were transition periods of 7 or 8 days each. Complete data are furnished for each experiment as to the composition of the feeds used, daily temperature of the stalls, daily amount of feces (fresh and on a dry matter basis), and average analyses for the same; and the daily water consumed, as well as the initial and final weight of each

wether. The complete data and methods of calculating the coefficients of digestibility for each animal in each test are given.

In experiment 1 clover hay alone was fed to two wethers during four periods. 600 gm. being fed daily per wether in periods 1 and 4, 900 gm. in period 2, and 1,200 gm. in period 3. In a second experiment composed of four periods, two wethers were again used, but the feed consisted of concentrates as well as roughage in the following amounts per day during periods 1 and 4: Clover hay 300 gm., gluten 100 gm., soy bean meal 100 gm., potato flakes 150 gm., and molasses feed 100 gm. During period 2 the amount of this mixture was increased by 50 per cent, and during period 3 the amount of the mixture fed to each wether per day was double that fed in period 1.

In the third experiment two wethers were again fed in a manner identical with that of the second experiment except that the ration was changed to 350 gm. of clover hay, 100 gm. of dried potatoes, 100 gm. of rice, and 80 gm. of gluten for periods 1 and 4. These amounts were again increased by 50 per cent for period 2 and by 100 per cent for period 3.

In the fourth experiment, consisting of two feeding periods, 4 wethers were used. In this experiment two rations were formed of the same feeds, but balanced differently so that the amount of digestible protein in each was the same. The energy value of one, called the "heavy ration," was greater, however, than the other or "light ration" by the equivalent of 2 kg. of starch per 1,000 kg. of the mixture. The heavy ration consisted of 225 gm. rice straw, 360 gm. dried beet pulp, 90 gm. wheat bran, 383 gm. corn meal, and 68 gm. sesame cake. The total dry matter of this ration was 966.9 gm. The light ration consisted of 225 gm. of rice straw, 360 gm. dried beet pulp, 90 gm. wheat bran, 248 gm. corn meal, and 90 gm. sesame cake. The amount of dry matter in this ration was 872.2 gm. During the first feeding period in this experiment two of the wethers were fed on each ration, and during the second period the rations were reversed for each animal. The following table shows the composition of the feeds used in the different experiments:

Composition of various feeding stuffs.

Experiment	Feed	Dry matter	Dry-matter basis.				
			Crude protein	N-free extract	Crude fat.	Crude fiber.	Ash.
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent.</i>	<i>Per cent</i>
I.....	Clover hay.....	84.90	10.26	51.61	1.86	29.89	6.38
	Clover hay.....	87.31	13.50	47.47	2.00	30.92	6.11
	Gluten.....	96.30	87.57	10.50	.34	.....	1.59
II.....	Soy-bean meal.....	80.92	52.62	32.84	1.83	6.27	0.44
	Potato flakes.....	85.92	6.76	86.80	.25	2.79	3.40
	Molasses feed.....	75.80	10.05	73.62	.26	10.22	5.85
III.....	Clover hay.....	84.90	10.26	51.61	1.86	29.89	6.38
	Dried potatoes.....	87.39	6.68	88.05	.29	1.57	3.41
	Rice.....	85.58	7.67	91.12	.56	.32	.33
IV.....	Gluten.....	96.25	87.64	10.24	.24	.....	1.88
	Rye straw.....	83.29	2.60	39.84	1.78	44.20	3.94
	Dried-beet pulp.....	88.54	8.66	59.94	.68	17.95	4.15
IV.....	Wheat bran.....	88.25	17.44	44.77	4.97	11.80	7.59
	Corn meal.....	84.53	10.04	67.74	3.33	1.79	1.43
	Sesame cake.....	88.62	47.35	19.04	4.79	6.92	10.71

The following table shows the average digestion coefficients which were calculated for the different periods for all of the experiments, as well as the total amount of feed consumed per wether per day during each feeding period:

Average coefficients of digestibility of the different rations.

Experiment	Period	Kind of ration	Daily feed consumed	Digestibility					
				Dry matter	Organic matter	Crude protein	Crude fat	N-free extract	Crude fiber
			Grams	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
I	1	Clover hay	600	56.3	58.5	54.2	51.1	63.6	54.9
	2	do	600	56.2	57.9	56.0	47.9	63.1	49.6
	3	do	1,200	55.5	57.4	54.1	52.4	63.4	48.1
	4	do	600	57.1	59.7	55.8	51.1	63.7	51.4
II	1	Mixture	750	77.7	79.9	81.2	28.0	81.1	62.2
	2	do	1,125	76.9	78.9	83.5	35.1	83.1	59.5
	3	do	1,500	75.5	77.5	82.0	38.0	82.5	55.5
	4	do	750	78.4	80.5	81.1	30.8	84.2	64.0
III	1	do	630	74.9	76.6	81.9	49.2	82.4	51.8
	2	do	915	72.6	74.2	79.3	48.7	79.9	50.0
	3	do	1,260	70.8	72.3	76.9	46.9	79.2	44.8
	4	do	630	76.1	76.1	82.2	47.7	83.5	51.8
IV	1	Heavy ration	1,026	69.9	72.0	57.6	50.4	79.9	54.2
	2	Light ration	1,013	69.4	71.6	67.6	50.2	79.6	52.0
	1	do	1,013	72.4	74.5	66.2	48.9	81.0	57.8
	2	Heavy ration	1,026	69.2	71.2	59.2	52.5	78.9	51.8

Increasing the size of the ration seemed to decrease the digestibility of all nutrients except the fat, which in some cases was slightly increased. These changes, however, were very slight in the average, but seemed to be subject to individual variation.

The nutritive value of cattle feeds.—III, Dried apple pomace for farm stock, J. B. LINDSEY, C. L. BEALS, and J. G. ARCHIBALD (*Massachusetts Sta. Bul.* 205 (1921), pp. 135-148).—This bulletin is the third of the series on the nutritive value of cattle feeds (*E. S. R.*, 46, p. 476). The composition, digestibility, and feeding value of dried apple pomace, the dried residue left from the manufacture of cider, have been studied by chemical analysis, digestion experiments with sheep, and feeding tests with dairy cattle.

Analyses showed that the composition of dried apple pomace compared quite closely with dried beet pulp, except that there was more protein and less fat in the latter. The total digestible nutrients in apple pomace were found by eight feeding trials with four sheep to be 81 per cent as great as the total digestible nutrients of corn meal, and the net energy was 72 per cent as great as that in corn meal.

In two feeding trials with 8 and 12 dairy cattle conducted by the reversal method from November 10, 1920, to May 10, 1921, dried pomace was compared with beet pulp and with corn meal for milk production. In the first experiment 6 to 7 lbs. of apple pomace or beet pulp was fed with hay and a grain mixture composed of 20 lbs. of bran, 30 lbs. of corn meal, 30 lbs. of coconut meal, and 20 lbs. of cottonseed meal. Four to 5 lbs. of apple pomace or corn meal was fed with hay and a grain ration of 40 lbs. of bran and 60 lbs. of cottonseed meal in the second experiment. Equal amounts of pomace and beet pulp were fed in the first test, whereas 17 oz. of corn meal per pound of pomace was fed in the second, due to the higher moisture content of the corn meal. The weights of the animals of the different groups showed no marked advantage for any of the rations, but in the first experiment the dried beet pulp increased the milk production 8.26 per cent, the total solids 4.79 per cent, and the total fat

6.47 per cent, whereas the corn meal produced the respective increases of 2.12, 3.69, and 5.55 per cent, as compared with the apple pomace rations.

The authors state that these increases were to be expected, since the corn meal and the dried beet pulp rations contained more total digestible nutrients and had narrower nutritive ratios than the apple pomace rations. The feeding of the dried apple pomace is recommended for dairy cows and sheep as a substitute for silage or as a component of a properly balanced grain ration.

Investigations of the feeding value of straw hydrolyzed by various processes.—II, Treating straw with caustic lime with and without pressure, F. HONCAMP and F. BAUMAN (*Landw. Vers. Sta.*, 98 (1921), No. 1-2, pp. 1-41).—To determine the value of treating rye straw with caustic lime, with and without pressure, feeding experiments with wethers are reported, continuing previous work (E. S. R., 46, p. 572). All feeding periods lasted 10 days, and in most cases two wethers were fed on the same feeds. The digestion coefficients of the organic matter, protein, nitrogen-free extract, fat, fiber, and ash were obtained for a basal ration and for rye straw untreated and cooked for 5 hours with 8 per cent caustic lime without pressure and with pressure of 4 to 5 atmospheres.

Cooking without pressure was found to almost treble the nutritive value of the straw and made 53 per cent of the organic matter digestible. By cooking under pressure the digestion coefficient was increased to 61 per cent for the organic matter, though there was a greater loss of this substance than in cooking without pressure.

In improving the digestibility of the organic matter this treatment then equaled the caustic soda treatment reported below and the dissolving out of the silicic acid and lignin was not as great with the caustic lime.

Investigations of the feeding value of straw hydrolyzed by various processes.—III, Treatment of straw with soda, F. HONCAMP and F. BAUMANN (*Landw. Vers. Sta.*, 98 (1921), No. 1-2, pp. 43-63).—The experiments reported in this article are very similar to those reported above, except that the rye straw was treated with soda instead of caustic lime. Cooking the straw with 8 per cent soda and 8 parts of water for four hours gave a coefficient of digestibility for the organic matter of 60.6 per cent as compared with 61.4 per cent for rye straw treated with 3.5 per cent caustic soda under pressure. The digested cellulose and pentosan were increased from 51.1 and 50.2 per cent, respectively, in the untreated straw to 95.2 and 94.2 per cent in the straw treated with soda.

Inspection of commercial feedstuffs, P. H. SMITH, E. M. BRADLEY, and J. T. HOWARD (*Massachusetts Sta. Control Ser. Bul.* 15 (1921), pp. 3-34).—This is a report of analyses of feeding stuffs collected by the State feed inspector from September 1, 1920, to September 1, 1921, including cottonseed meal, linseed meal, gluten meal, gluten feed, distillers' dried grains, brewers' dried grains, standard wheat middlings, red dog flour, wheat mixed feed, wheat bran, rye middlings, corn meal, ground oats, hominy feed, dried beet pulp, oat feed, alfalfa meal, meat scrap, meat and bone scrap, bone meal, and fish scrap, as well as the usual proprietary stock and poultry feeds.

The average prices during 1920-21 are also given for these feeds. The results of the inspection are discussed, as well as a definition of wheat mixed feed and a discussion of some recent aspects of animal nutrition.

Feeding stuffs report, 1920, J. W. KELLOGG (*Penn. Dept. Agr. Bul.* 356 (1921), pp. 303).—This bulletin reports the price and the moisture, protein, fat, and fiber analyses of 1,100 samples of feeding stuffs collected during 1920 in Pennsylvania, as well as a list of 662 different kinds and brands of feeding

stuffs registered for sale in that State. The feeds analyzed include samples of cottonseed meal, cottonseed feed, linseed-oil meal, distillers' dried grains, brewers' dried grains, corn-gluten meal, corn-gluten feed, hominy feed, corn bran, corn-feed meal, wheat bran, wheat middlings, wheat mixed feed, wheat shorts, low-grade wheat flour, rye middlings, oat feed, barley mixed feed, buckwheat middlings, buckwheat feed, alfalfa meal, dried beet pulp, blood meal, meat and bone scrap, fish scrap, and tankage, as well as the usual proprietary poultry and stock feeds.

Review of the frozen meat trade, 1921, W. WEDDEL & Co., LTD. (*Weddells Ann. Rev. Frozen Meat Trade*, 34 (1921), pp. 30).—This continues the annual reports of the British trade in beef, mutton, and lamb carcasses previously noted (E. S. R., 44, p. 866).

The cattle of Friuli, F. BRUNNER (*Deut. Landw. Tierzucht*, 24 (1920), No. 24, pp. 249-251, fig. 1).—The breeds of cattle of this Italian Province are described from observations made by the author, supplemented by information furnished by D. Savia, of Udine, and Spann, of Weißenstephan. Four breeds were found in Friuli, which were designated as follows: (1) The old Friulian red cow, (2) the new red colored Friulian cow, (3) the Carinthian cow, and (4) a breed with characteristics like the brown cow. A description of each breed is given, together with what is known of their origin.

The Herdwick sheep, A. E. REM (*Jour. Min. Agr. [London]*, 28 (1921), No. 6, pp. 501-505, pls. 2).—The origin, history, description, and characteristics of Herdwick sheep are here reported.

Ovarian testes in the goat, G. KREBIER (*Biol. Zentbl.*, 41 (1921), No. 10, pp. 447-455).—The author reports the frequency of cases of hermaphroditism or pseudohermaphroditism in goats which have come under his observation, in which the animals have the external genital organs of the female but have the appearance and actions of the male or vice versa. A detailed description of the genital organs of three such cases is given.

In animals with apparently normal external female genital organs but with the appearance and action of males, the ovaries as well as other parts of the internal genital organs were found to be abnormal. In one case the ovaries contained considerable testicular tissue, and in other cases ovarian tissue was found in the testicles. The analogy between this hermaphroditic condition in goats and freemartins in cattle is brought out.

The cost of horse labor, A. G. RUSKIN (*Jour. Min. Agr. [London]*, 28 (1921), No. 9, pp. 810-816).—Data collected by the department of agriculture of the University of Leeds on the cost of horse labor from 1908 to 1921 is reported. The pounds of feed consumed per head is listed, as well as the estimated cost of feed, veterinary fees, cost of buildings, etc.

Studies on the physiology of reproduction in the domestic fowl. - XIX. On the influence of free choice of food materials on winter egg production and body weight, R. PEARL and T. E. FAIRCHILD (*Amer. Jour. Hyg.*, 1 (1921), No. 3, pp. 253-277).—An experiment in free choice feeding of poultry is reported as carried on at the Maine Experiment Station. In the fall of 1916 60 pullets were placed in one end of a long laying house, and 61 pullets as near alike as possible placed in the other end with a wire partition between. The pens were called A and B. Pen B received the regular Maine Station ration composed of cracked corn, wheat, oats, shell, grit, green feed, and dry mash (corn meal, bran, middlings, and meat, with gluten and linseed meals added from time to time). Pen A received wheat, cracked corn, oats, bran, red dog flour, linseed meal, bone meal, meat scrap, shell, grit, charcoal, and green feed fed in separate compartments which were kept well filled at all times. Records of

the feed consumed and weights and measurements of the public bones of the individual birds were made every 28 days.

The results show that the free choice lot, while keeping their weights about uniform, laid slightly more eggs than the other lot and consumed less feed. In the feed consumption, however, there was considerable difference in choice of feeds. Pen A ate 588.12 kg. of whole grain against 389.8 kg. for pen B, but the latter ate 442.14 kg. of mash as compared with 128.02 kg. for pen A. The nutritive ratio of the ration fed pen B was about 1:4, whereas the birds having free choice of their feed balanced their ration at about 1:6. The small amount of beef scrap consumed by these birds was also notable.

The eighteenth paper of this series has been reported (E. S. R., 47, p. 75).

Annual report of the poultry department, E. P. CLAYTON (*Mississippi Sta. Rpt. 1921, pp. 39, 40*).—In a test comparing four breeds it was found that Brown Leghorns laid 126 eggs per hen per year, White Leghorns 156, Rhode Island Reds 112.5, and Barred Plymouth Rocks 107. Per hen 61, 69, 72, and 76 lbs. of feed were consumed for each breed, respectively, and the respective average profits per hen were \$1.84, \$2.26, \$1.20, and 29 cts.

Artificial incubation, J. E. DOUGHERTY (*California Sta. Circ. 233 (1922), pp. 10, figs. 4*).—This circular gives directions for selecting eggs for hatching and instructions for preparing and running an incubator.

Monthly standards for New Jersey poultry farms, W. H. ALLEN (*New Jersey Sta. Hints to Poultrymen, 10 (1922), No. 6, pp. 4*).—In this circular tables are prepared from data collected on cooperating New Jersey poultry farms to give averages of the summaries of the eggs produced and the feed consumed by the birds during each month of the year. The averages for each month are suggested as standards for egg production and feeding for New Jersey poultry.

Turkey raising, H. M. LAMON and R. R. SLOCUM (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trubner & Co., Ltd., 1922, pp. X+151, pls. 41*).—In this book on general turkey production the following points are taken up: History, extent, and opportunities of the industry; varieties, mating, and showing; management of the breeding stock; incubation; brooding and rearing the young stock; marketing; and insect pests, diseases, and predatory animals.

Practical facts for the squab raiser, W. C. THOMPSON (*New Jersey Sta. Hints to Poultrymen, 10 (1922), No. 7, pp. 4, fig. 1*).—General instructions for beginners in pigeon management and production are briefly given.

Further data on the inheritance of blue in poultry, W. A. LIPPINCOTT (*Amer. Nat., 55 (1921), No. 639, pp. 289-327, figs. 22*).—In a continuation of studies on the inheritance of blue in poultry previously reported (E. S. R., 41, p. 76), it has been determined that three factors are responsible for this color, 1 e, *P* necessary for the production of black, the recessive giving white; *E* an extension factor for extending black to all feathers of the body; and *R* a restriction factor which restricts black to produce blue. Another factor which is also considered is the factor *Ip* which inhibits *P* and produces white in Leghorns.

In crossing White Wyandottes, White Plymouth Rocks, Black Langshans, Blue Orpingtons, and two Blue Leghorn hens with Andalusians, the colors produced were found to be due to the factors above mentioned in all cases. In the above determinations males and females of each breed were used except as noted, as well as black, blue, and blue-splashed Andalusians of both sexes. Good agreement with the theoretical proportions were obtained in all cases except in the *F*'s from blue-splashed Andalusians and recessive whites. In these crosses only one of six males used gave a close agreement to expectations.

The possibility of differential viability or linkage is suggested as the cause of the irregular ratios, though no determinations could be made of such from the data. With respect to the factors *R*, *P*, and *B*, the different breeds used were found to be of the following formulas: Blue-splashed Andalusians and Orpingtons *PP* (*Rc*) (*Re*); blue Andalusians and Orpingtons *PP* (*Re*) (*rE*); black Andalusians, Orpingtons, and Langshans *PP* (*rE*) (*rE*); and White Plymouth Rocks and Wyandottes *pp* (*rE*) (*rE*).

No evidence of linkage or crossing-over between any of the factors was observed with the possible exception of the *F₂* crosses, but there is some evidence presented that the ovaries tend to assist in the restricting properties of the factor *R*, though there was no indication of any inhibition of this factor by the testes.

Attention is drawn to the economic importance for blue Andalusian and blue Orpington breeders of finding characters for blue which would breed true and thus do away with the necessity of discarding half the offspring because they are offcolor.

Skunk breeding, with notes on mutations and their genetic behavior. J. A. DETILESEN and F. M. HOLBROOK (*Jour. Heredity*, 12 (1921), No. 6, pp. 242-254, figs. 9).—This article discusses economic skunk production, with special reference to feeding and breeding. The frequent occurrence of color mutants is noted, together with a list of mutants which have been reported. The mutant for white coat seems to behave with reference to the normal black with some white as a simple Mendelian recessive. Besides the production of self color, other problems of skunk breeding deal with the improvement of the size and quality of the pelts.

Genetics of the Vienna White rabbit, [I], II. W. E. CASTLE (*Science*, n. ser., 55 (1922), Nos. 1419, pp. 269, 270; 1425, pp. 429, 430).—In discussing the genetics of the Vienna White rabbit reported by E. Baur, the author calls attention to the similarity between this type of rabbits and silver agouti guinea pigs. In the case of Baur's experiments in which he mated an albino rabbit with a Vienna white rabbit and got black offspring, the author states that this must have been black chinchilla (E. S. R., 45, p. 168) and not an ordinary black.

After reporting the above work, the author received and experimented with a pair of Vienna White rabbits from Europe. When mated with yellow rabbits blue, black, and gray young were produced, depending upon the constitution of the yellow parent. The young were also found to be Dutch marked. These results then agree with Baur's experiments, and the rabbits used in the article reported above are stated as not being the same as the Vienna White rabbit of Europe, though they looked like them. The Vienna White rabbit is in reality a Dutch rabbit with a completely white coat.

Alcoholism and the behavior of white rats.—I, The influence of alcoholic grandparents upon maze behavior. E. C. MACDOWELL and E. M. VICARI (*Jour. Expt. Zool.*, 33 (1921), No. 1, pp. 209-291, figs. 17).—This is the report of a study of the habit-forming ability of 31 rats whose grandparents were repeatedly treated daily with alcohol fumes to determine the possibilities of modifying inheritance by alcohol. The results are based on the time required for these rats to find their way from the outside of a maze consisting of five partitions to the center where food was located. In these trials 29 rats whose grandparents were full brothers and sisters of the rats treated with alcohol were used as controls.

The author concludes that strong doses of alcohol would be required before any influence could be exerted on the germlasm, but with the strong doses used on the grandparents in this test the results seemed to indicate that the inheritance has been modified by alcohol to a certain degree.

Alcohol and white rats: A study of fertility, E. C. MACDOWELL (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 2, pp. 69-71).—In experiments in treating rats with alcohol fumes reported above, it was found that the litters of treated rats were 10 per cent smaller than the litters of untreated rats. The number of litters were very much less for the treated rats, as 44 treated pairs produced 32 litters, whereas on the basis of the controls (full brothers and sisters) 91 litters were expected. The treated offspring of treated rats came nearer to producing the normal number of litters. This is probably because selection occurred in having these offspring produced only from the better producing parents, and this tendency of better production was probably inherited.

The American Society of Animal Production.—Record of proceedings of annual meetings, 1917-1919 (*Amer. Soc. Anim. Prod. Proc. 1917-1919, pp. 112, figs. 3*).—This is a combined report of the annual meetings held in December, 1917, 1918, and 1919. Included are the following papers: The influence of Drugs on Milk and Butter Fat Production, by A. C. McCandlish (E. S. R., 41, p. 181); The Results of an Investigation on Raising Beef Cattle, by B. O. Severson (E. S. R., 44, p. 769); The Peanut Pork Problem, by L. B. Burk; Corn Silage and Cottonseed Meal as Principal Foods in Beef Production, by W. H. Tomhave (E. S. R., 43, p. 569); The Mineral Metabolism of the Milch Cow, by E. B. Forbes; Brood Mares for Farm Work, by E. A. Trowbridge; A Further Study of Milk Substitute Materials in Feeding Dairy Calves, by R. E. Caldwell (E. S. R., 42, p. 471); Teaching Animal Husbandry in War Time, by W. C. Coffey; The Influence of Sexual Activity of Male Rabbits, by O. L. Jones and F. A. Hays (E. S. R., 42, p. 467); Thyroid Hyperplasia and the Relation of Iodin to the Hairless Pig Malady, by F. B. Hart and H. Steenbock (E. S. R., 39, p. 187; 40, p. 185); Alfalfa as the Sole Feed for Dairy Stock, by F. W. Woll; Some Signs of the Times, by J. M. Evvard; Comparison of Feeding Standards for Dairy Cows, by F. B. Morrison (E. S. R., 45, p. 273); Value of Barley, Barley Feed, and Fishmeal for Fattening Pigs, by F. B. Morrison and G. Bohstedt; The Fence Problem on Western Ranges, by R. H. Williams; Corn Gluten Feed for Fattening Fall Pigs, by J. M. Evvard (E. S. R., 41, p. 272); A System for a Registry of Merit for Pedigreed Meat Producing Types of Animals, by H. W. Mumford; An Appetite Study with Dairy Calves, by A. C. McCandlish (E. S. R., 42, p. 172); What Should Be the Attitude of Experiment Stations Toward Mixed Feeds? by H. S. Grindley and S. Bull; Factors in the Cost of Corn Silage, by J. W. Whisenand; Barley and Dairy By-products for Swine Feeding, by F. B. Morrison and G. Bohstedt (E. S. R., 44, p. 268); War Time Sources of Feeding Stuffs in Germany, by L. A. Maynard; On Correlation Between Milk Production, Fat Production, and Other Associated Characters, by F. A. Pearson; and A Study of Sires, by A. C. McCandlish and L. M. Winters (E. S. R., 45, p. 72).

The American Society of Animal Production.—Record of proceedings of annual meeting November, 1920 (*Amer. Soc. Anim. Prod. Proc. 1920, pp. 76*).—This report of the 1920 meeting includes the following papers: Nutritional Factors in Swine Feeding, by F. B. Morrison (E. S. R., 43, p. 774); Work of the Montana Experiment Station on Sunflowers as a Silage Crop, by W. E. Joseph (E. S. R., 43, p. 68); The Effect of Early Breeding on Range Cows, by C. W. McCampbell (E. S. R., 44, p. 470); Unlimited Silage Ration for Fattening Cattle, by W. H. Tomhave; The Relation of Carcass Perishability to Live Stock Prices, by E. N. Wentworth; Increasing the Butter Fat Percentage in Milk Through the Use of Cottonseed Meal, by A. C. McCandlish (E. S. R., 46, p. 370); Performance in Some of the Leading Guernsey Sires, by D. Meade (E. S. R., 45, p. 777); Grazing Experiments in North Dakota, by P. F. Trow-

bridge (E. S. R., 45, p. 267); The Use and Possibilities of a New and Simplified Type of Respiration Chamber, by E. G. Ritzman (E. S. R., 44, p. 68); Some Observations on Weights of Swine, by J. W. Carmichael; The Feeding of Grain Sorghums to Hogs, by H. B. Winchester (E. S. R., 45, p. 575); Corn Stover Silage v. Corn Silage for Milk Production, by F. B. Morrison, G. C. Humphrey, and R. S. Hulce (E. S. R., 45, p. 174); Calcium and Phosphorus as the Limiting Factors for Milk Secretion, by E. B. Meigs (E. S. R., 45, p. 274); and Cane v. Beet Molasses for Fattening Two-year-old Steers, by J. M. Evvard (E. S. R., 46, p. 362).

DAIRY FARMING—DAIRYING.

The improvement of dairy cattle in Denmark, G. LEBLANC (*Rev. Zootech. [Paris]*, No. 6 (1922), pp. 541-550, figs. 3).—This is a report of the results which have been obtained by the Danish Society for the Control of Dairying since its organization in 1895, and now based on 15,000 herds of 250,000 cows. Success has been obtained in increasing the milk and butter production, and efforts have also been directed toward the economy of milk production and breeding. The importance of herdbooks, the part played by bulls, and the transmission of capacity for milk production have been recognized.

Crossing Jerseys with black and white cattle, G. M. V. D. PIANK (*Genetica [The Hague]*, 2 (1920), No. 4, p. 300).—After referring to work previously reported by Kuiper (E. S. R., 43, p. 375), this article describes six calves from a Jersey cow which was alternately bred by black and white bulls. The calves were brown in color, a little darker than the Jersey, and with a little white on the belly but without the light Jersey ring around the muzzle.

Who's who among Holstein-Friesian sires, R. E. HUNT (*Va. Agr. Col. Ext. Bul.* 66 (1921), pp. 14).—The advanced registry sires whose daughters are listed in volumes 24-31 of the Holstein-Friesian Advanced Registry are classified according to the number of their daughters that have produced over 1,000, 800, and 600 lbs. of butter fat in a year. The records of all immature daughters were corrected to mature age. A table of ancestry of the more important sires is also included.

Purebreds excel by 40 per cent, D. S. BURN (*Holstein-Friesian World*, 19 (1922), No. 18, p. 1380).—Some results of purebred sires on farms are reported as obtained from an inquiry conducted by the Bureau of Animal Industry, U. S. D. A.

First annual report of the Oostburg [Wis.] Cow Testing Association, 1920 (*Oostburg [Wis.] Cow Testing Assoc. Ann. Rpt.*, 1 (1920), pp. 4).—A list of 42 cows which qualified for the Register of Production during the year ended June 30, 1920, is included.

Second annual report of the Oostburg [Wis.] Cow Testing Association, 1921 (*Oostburg [Wis.] Cow Testing Assoc. Ann. Rpt.*, 2 (1921), pp. [6], fig. 1).—This report for the year 1920-21 gives a history of the Oostburg Cow Testing Association and describes the benefits which have resulted from it. A list of 46 cows which qualified for the Register of Production is also given, together with their individual records.

Third annual report of the Cedar Grove [Wis.] Cow Testing Association, 1920 (*Cedar Grove Wis.] Cow Testing Assoc. Ann. Rpt.*, 3 (1920), pp. 7).—A list of 79 cows which qualified for the Register of Production during 1920 is given.

Fourth annual report of the Cedar Grove [Wis.] Cow Testing Association, 1921 (*Cedar Grove [Wis.] Cow Testing Assoc. Ann. Rpt.*, 4 (1921), pp. [7], fig. 1).—This report for the year 1920-21 gives the history of the associa-

tion, by H. Molter, showing the improvement which has been made in the herds in the association. Of 583 cows tested during the year, 384 completed the year's record, of which 101 qualified for the Register of Production.

The standard herd test, J. M. KERR (*Jour. Dept. Agr. Victoria, 18 (1920), No. 9, pp. 513-572, figs. 18*).—This is a report of the herd testing of dairy cattle by the Victoria Department of Agriculture for the year ended June 30, 1920. Besides listing the records of cows which exceeded the requirements, a complete discussion of the testing work is given, explaining the advantages which may be obtained from accurate records of the production of milch cows.

[Early v. late calving for dairy cows], J. S. MOORE (*Mississippi Sta. Rpt. 1921, pp. 32, 33*).—A note on the results of 3 years' work to determine the advantages of spring and fall calving with dairy cattle states that cows calving in the fall produced an average of 172 lbs. of milk and 184 lbs. of butter fat more than cows calving in the spring. In a comparison of early and late fall calving the average difference per year per cow was 683 lbs. of milk and 27.5 lbs. of butter fat in favor of late fall calving.

The dairy calf, E. L. JENSEN (*Pacific Dairy Rev., 26 (1922), No. 12, pp. 16, 17*).—This is an appeal to dairymen to raise more of their heifer calves which have been sired by a purebred bull out of good producing cows. General instructions for raising dairy calves are also included.

Tenth annual report of the International Association of Dairy and Milk Inspectors, compiled by I. C. WELD (*Internat. Assoc. Dairy and Milk Insp. Ann. Rpt., 10 (1921), pp. 312, figs. 8*).—This is a report of the 1921 meeting of the International Association of Dairy and Milk Inspectors held at New York City, November 14-16. Committee reports were given on bovine diseases, by J. B. Hollingsworth; transportation and marketing of milk and milk products, I, transportation, by W. E. Ward; II, transportation of milk in Connecticut, by T. Holt; III, Marketing, by W. P. B. Lockwood, and IV, by H. E. Bowman; city milk contests, by R. S. Smith; remade milk, by O. L. Evenson; pasteurization of milk and cream, by C. H. Kilbourne; food value of milk and milk products, by G. B. Taylor; serving milk in the schools, by H. A. Harding; bacterial analysis of milk and milk products, by G. E. Bolling. There were also the following papers: A Comparison of the A. P. II. A. Standard Milk Agar of 1920 with Ayers' Milk Powder Agar, by H. N. Parker; Practical Methods in Improving a City Milk Supply, by H. R. Estes; Some Misinterpretations of the Government Score Card, by W. E. Ward; Powdered Milk and Public Health, by R. M. Washburn; Bacterial Quality of Machine and Hand Drawn Milk, by G. C. Supplee; The Value of Milk, by R. S. Smith; New York's Milk Supply and Its Control, by O. Salthe; Milk and Its Relation to Human Welfare, by H. E. Van Norman; Filled Milk, by M. D. Munn; Cooperation in Dairy Inspection, by F. D. Walmsley; Milk Distribution by Producers' Cooperative Associations, by C. E. Clement; A Suggested Modification in the Public Control of Milk Supplies, by C. H. Kilbourne; Why the Milk Inspector Should be a Showman, by A. W. Lombard; Detecting Sources of Milk Contamination by Means of the Direct Microscopic Method, by T. J. McInerney; Contagious Abortion, by G. H. Grapp; The Supervision of Milk Pasteurization in Minnesota, by H. A. Whittaker; Milk Regulation by a Milk Regulation Board, by T. Holt; The Production and Consumption of Milk and Milk Products, by C. W. Larson; Methods of Caring for Milking Machine Tubes, by R. S. Breed; Health Department Supervision of Pasteurization Plants in a Small City, by I. V. Hiscock; Relation Between Milk Dealers and Milk Inspectors, by B. Vener; The Effect of Pasteurization on Cream Layer, by H. A. Harding; Improvement of Quality in Milk Through College Extension Work, by W. A. Stocking; Production of

Certified Milk and Its Results, by A. Forrest; **The Transportation and Marketing of Milk**, by C. W. Eddy; **Safe Milk, the Object of Pasteurization**, by S. M. Heulings; **Vitamins in the Dairy Ration and Their Effect on Milk and Milk Products**, by R. C. Colwell; **Educational Work and Advertising as an Aid in Marketing Milk**, by W. P. B. Lockwood; **Plea for Discrimination in the Selection of Milk Distributors**, by J. O. Jordan; **Pertinent Observations of Conditions at Country Creameries**, by W. E. Ward; **The Function of the Sanitarian in the Condensery**, by J. Gaub; and **Comparison of the Efficiency of Four Different Types of Pasteurizing Machines**, by C. H. Chilson.

Previous reports of this association have been noted (E. S. R., 46, p. 174.)

Studies in city milk distribution, S. J. BROWNELL (*Michigan Sta. Spec. Bul. 111 (1921), pp. 24, fig. 1*).—A report of studies of milk distribution in East Lansing, Lansing, Kalamazoo, and Flint, Mich., is given. This work was carried on by making one complete trip with each delivery wagon in the cities mentioned. Records were kept of the route traveled, stops made, size of the load, time of delivery, milk sold, etc. The amount of duplication in delivery and the miles traveled were computed for each driver. Comparative studies were made between the miles traveled, quarts sold per mile, time to deliver a load, quarts sold per hour, and milk delivered and deliveries of baked goods.

The results of the studies indicate that in Kalamazoo, Lansing, and Flint 84.13, 79.41, and 48.62 per cent, respectively, of the duplication in milk delivery was unnecessary, and that 43.24, 26.92, and 25 per cent, respectively, of the wagons used were not necessary for delivering the respective amounts of milk. It is further brought out, however, that if the unnecessary duplication in delivery and the extra wagons were taken away it would only reduce the total cost of milk to the consumer by 3.76, 2.26, and 2.08 per cent in the respective cities, with a sacrifice in service to the consumer. The efficiency of milk delivery was found to compare favorably with the efficiency of delivering baked goods in these cities. Due to the varied ability of drivers, kind of delivery vehicle, the kind of roads, etc., there did not seem to be any close relationship between the distance traveled and the time required for delivering a definite amount of milk in any of the cities.

An experiment in improving the milk supply of a city milk plant, L. H. COOLEGE and O. T. GOODWIN (*Michigan Sta. Spec. Bul. 112 (1921), pp. 3-16, figs. 3*).—The results of a milk contest held to improve the milk supply of a milk plant in East Lansing, Mich., and also to test out the use of the colorimetric hydrogen-ion method of scoring milk, as developed by Coolege and Wyant (E. S. R., 43, p. 615), are reported. Samples of milk from each producer delivering milk to the plant were examined by the pH method, bacteriological count, Weinzirl spore test for manual contamination (E. S. R., 45, p. 73), and temperature of milk. It was found that the pH score was a very satisfactory basis for scoring milk contests. In using the Weinzirl test the pH score should also be considered. Cheese made from milk with a high pH score was found to be of better quality and texture than from milk with a low pH score.

The action of metals on milk, M. DONAUER (*Butter, Cheese, and Egg Jour., 13 (1922), No. 18, pp. 12, 14, 16, 18, figs. 5*).—In this study of the amount of metals absorbed by milk products the results are reported as the number of milligrams of the various metals absorbed by sweet and sour milk and a 0.2 per cent solution of lactic acid per square centimeter of surface exposed for one day at pasteurizing temperature and at storage temperature. For sweet milk at pasteurizing temperature the amounts of some of the metals absorbed were approximately as follows: Bronze 0.04 mg., copper 0.08, tin 0.1, aluminum 0.2, iron 0.8, and zinc 1.6 mg. The amounts of these metals

absorbed at normal storage temperature were found to be about one-tenth those at pasteurizing temperature.

Studies of the amount of the metallic lactates required to give a distinct taste in water showed considerable variation, as follows: Aluminum 1:110,000, copper 1:210,000, tin 1:25,000, and iron 1:70,000. Since metallic lactates are readily absorbed by the fat, the flavor of butter may frequently be affected by absorbed metals. A discussion is also presented of the possibilities of absorbed metals hastening decomposition and putrefaction in milk products.

The use of aluminum in dairying, E. DROUILLY (*Lait*, 1 (1921), No. 5, pp. 228-242, figs. 11).—This article discusses the properties of aluminum which made it desirable as a substance from which to manufacture milk cans and also receptacles for retailing milk. The main points to be considered are its lightness, malleability, conductivity, and resistance to the action of air, water, and organic acids.

Studies of lactic fermentation, C. RICHEA, E. BACHRACH, and H. GARDOT (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 13, pp. 842-845, figs. 2).—In this study, dealing with the growth of two strains of milk-fermenting bacteria on different media, diagrams are shown comparing the growth of the two strains on normal media and then on media containing 0.075 and 0.01 per cent of K_2AsO_4 , 0.25 and 0.5 per cent $CdSO_4$, and 0.05 per cent $CuSO_4$. In view of the fact that one culture grew better on the arsenic and cadmium media and not so well on the copper media as the other, the two strains are considered as being different physiologically.

Experiments on lactic ferments, GORINI (*Lait*, 1 (1921), No. 2, pp. 57-62). This is a short popular report of the work done by the author from 1911 to 1920 on the biology of lactic ferments, most of which has been previously reported (*E. S. R.*, 45, p. 476).

A study of milk during foot-and-mouth disease, A. CHOLLET (*Lait*, 1 (1921), No. 6, pp. 273-280).—Analyses of the milk of seven cows from two different dairies, previous to and during an epidemic of foot-and-mouth disease, are reported in tables showing the acid content, density, fat, sugar, salts, casein, and dry matter, as well as the quantity produced. During the height of the disease the amount of milk was decreased and the composition was changed. There was a considerable variation in the changes which occurred in the two dairies, but the percentage of fat and ash seemed to increase with a decrease in the percentage of lactose.

Table for computing the amount of butter fat in milk; arranged especially for use in making official Holstein-Friesian records, H. C. McLAULEN (*Uthava*; Cornell Univ., pp. 11).—This is a table for quickly computing the amounts of butter fat in milk when the fat percentage and the amount of milk are known. It is designed mainly for the use of advanced registry testers in making out their reports.

Butter making on the Arizona farm, W. S. CUNNINGHAM (*Arizona Sta. Yearly Hintz for Farmers*, No. 137 (1922), pp. 8, figs. 4).—This popular presentation of the principles of farm butter making discusses the care, handling, and ripening of the cream; churning; and the preparation of the butter for marketing, as well as brief instructions for scoring butter.

The butter situation in Denmark, A. H. GOODHUE (*Butter, Cheese, and Egg Jour.*, 13 (1922), No. 7, pp. 26-28, fig. 1).—This article describes the methods of butter production in Denmark. Among the more noticeable things mentioned were the facts that whole milk is delivered to the creameries, and that the laws require that the skim milk be pasteurized before it can be taken back to the farms for stock feeding.

The ratio of casein to fat as a factor influencing the quality of Swiss cheese. K. J. MATHESON (*Butter, Cheese, and Egg Jour.*, 13 (1922), No. 7, pp. 32-36, fig. 1).—The author reports the results of studies and observations on the cause of the occurrence of glass cheese in the manufacture of Swiss cheese. It is usually found more prevalent during the summer months, and observations and experiments reported indicate that it is caused by a change in the ratio of the casein to fat. More glass cheese occurred where the fat content of the milk was above 4 per cent and where there was less than 0.75 lb. of casein to 1 lb. of fat.

VETERINARY MEDICINE.

Home doctoring of animals. H. LEENLY (*London: MacDonald & Martin*, 5. ed., rev. and enl., pp. V+343, figs. 119).—This is a revised and enlarged edition of a popular account of the diseases of domestic animals, with remedial measures.

Some internal parasites of Oklahoma live stock. J. E. GUBERLET (*Oklahoma Agr. Col., Ext. Circ.* 127 (1921), pp. 15).—This is a summary of information on live stock parasites and means for their control.

Proceedings of the Wisconsin Veterinary Medical Association, 1922 (*Wis. Vet. Med. Assoc. Proc.*, 7 (1922), pp. 106, figs. 9).—Among the more important papers here reported are the following: Mastitis in Cows, by W. F. Nolechek (pp. 34-37); Control of Roup and Chicken Pox, by B. A. Beach (pp. 37-42); Health in Relation to Feeding of Live Stock, by J. M. Fargo (pp. 43-52); Swine Diseases as We Find Them in the Field, by W. H. Dreher (pp. 58-65); The Value of Bacterins in the Treatment of Swine Diseases, by W. L. Richards (pp. 65-67); Suggestions for the Care of Swine Before and After Vaccination, by R. S. Heer (pp. 67-71); When and How to Vaccinate Hogs, by J. R. Fesler (pp. 71-73); The Practicing Veterinarian and the Accredited Herd Work, by J. G. Townsend (pp. 74-77); What We Now Know About Abortion, by F. B. Hadley (pp. 83-90); and Forage Poisoning, by R. Graham (pp. 90-98).

Report of the departmental committee appointed to consider and report upon the legislative and administrative measures necessary to secure adequate protection for the health of the people in connection with the slaughter of animals and distribution of meat for human consumption in England and Wales. H. C. MONRO ET AL. (*London: Min. Health, Com. Meat Insp.*, 1921, pp. 53).—The work of this committee is reported under the headings of the licensing and registration of premises and persons, the inspection of meat, slaughterhouses—public and private—the transport and handling of meat, and compensation to butchers in respect to animals discovered on slaughter to be diseased.

Diseases of animals in South Africa. C. R. EDMONDS (*London: Baillière, Tindall, & Co.*, 1922, pp. XI+477, figs. 36).—Part 1 (pp. 15-212) of this work deals with diseases caused by vegetable parasites; part 2 (pp. 213-416) with diseases caused by animal parasites, insects, and worms; and part 3 (pp. 417-472) with diseases caused by an ultraviolet virus.

Annual report on the Civil Veterinary Department, United Provinces, for the year ending March 21, 1921. S. G. M. HICKEY (*United Provs. [India] Civ. Vet. Dept. Ann. Rpt.*, 1921, pp. [4]+22, pl. 1).—The usual annual report (*E. S. R.*, 45, p. 881).

Development of the chemotherapy of organic arsenicals and the related physical phenomena. C. N. MYERS (*Jour. Lab. and Clin. Med.*, 7 (1921), No. 1, pp. 17-38, figs. 3).—"The chemotherapeutic development of arsenicals is discussed, showing the relation of pentavalent arsenical products to those of the

trivalent condition as illustrated in the 'arseno' type. The rationale of the physiologic action is discussed from the chemical point of view, showing the effect of the chemical action of mass, concentration, and pharmacodynamics. A complete chart showing all the possible methods of arriving at the final product salvarsan (with references) is given.

"Methyl alcohol of crystallization is discussed with sufficient fullness to exclude it in the calculation of the often debated ' $2H_2O$ ' content. Anhydrous arsphenamin is a practical test of the purity of the technical products. The lethal dose of 'arsenoxid' is found to be about 25 mg per kilogram of animal weight. Impurities and their relation to toxicity are discussed. There is no relation between 'arsenoxid content' and the toxicity of various samples. The chemical transformation of the product is shown in a chart showing the opportunities for physical chemical changes to take place. The physical chemistry of arsphenamin is given with reference to the presence of colloidal properties and a discussion of the question of solutions in reference to viscosity, potential, dissociation, equilibrium, and ultrafiltration and their relation to toxicity. The administration of the drug in relation to concentrated and dilute solutions is discussed. Standing for 30 minutes tends to decrease the toxicity of freshly alkalized solutions of arsphenamin. Need of clinical standardization is pointed out. Reactions are explained in terms of disturbances of chemical equilibrium (precipitates)."

On the antigenic properties of acetone-extracted bacteria, S. R. DOUGLAS and A. FLEMING (*Brit. Jour. Expt. Path.*, 2 (1921), No. 3, pp 131-140) — The authors suggest the use of acetone extraction to obtain bacteria in a sterile dry form for use as antigens, and present the results of a study of the properties of bacteria thus extracted as compared with bacterial vaccines prepared in other ways.

The method of preparing the acetone-extracted organism consists in allowing a measured suspension in salt solution of a 48-hour agar culture to stand for 24 hours in an excess of acetone, after which the clear supernatant fluid is decanted and the residue extracted with acetone in a Soxhlet apparatus for 40 hours. The solid mass is then allowed to dry at room temperature or in the incubator at 37° C. Organisms thus prepared are said to show no changes in microscopic properties, to be very easily dissolved by tryptic and other proteolytic ferments, to have antigenic properties fully as great as vaccines made by other methods, and to be suitable for use in complement fixation tests.

"Preliminary experiments appear to show that acetone-extracted bacilli which have been digested with trypsin when injected into animals produce a marked increase (equal to or greater than undigested bacilli) of the bactericidal power, but the increase of the agglutinating power is very much less marked."

Anthrax (*U. S. House Represent.*, 67. Cong., 2. Sess., Com. Interstate and Foreign Com. Hearings on H. R. 7156, 1922, pp. 31).—This report of hearings before the Committee on Interstate and Foreign Commerce of the House of Representatives on a bill to prohibit the interstate sale of certain articles contaminated with anthrax includes statements by J. W. Schereschewsky, J. P. Leake, and G. W. McCoy.

Ascaris larvae in the brain, F. FÜLLEBORN (*Arch. Schiffs u. Tropen Hyg.*, 25 (1921), No. 2, pp. 62, 63).—In continuation of earlier investigations¹ in which the author, after having fed ripe eggs of *Ascaris lumbricoides*, found ascaris larvae in the kidneys as well as in the lungs, liver, etc., he reports the finding of ascaris larvae in the brain of experimental animals some days after having

¹ *Arch. Schiffs u. Tropen Hyg.*, 24 (1920), No. 11, pp. 340-347.

fed ripe eggs to them. Apparently the brain reacts very slightly to the wandering of the minute larvae, as he has never observed brain symptoms in any of his experimental animals. Even the introduction of numerous larvae into the brain by way of the carotid did not produce any brain symptoms. After a week following the feeding there were few ascaris larvae in the brain, and it was assumed that they returned to the lungs in the circulation. It is concluded that ascaris larvae which pass through the lungs and reach the brain through the blood stream are harmless in man.

On *Bacillus welchii* haemotoxin and its neutralization with antitoxin. H. HENRY (*Jour. Path. and Bact.*, 25 (1922), No. 1, pp. 1-18, figs 7).—This report deals with an *in vitro* investigation of the hemolyzing substance present in *B. welchii* toxin, including its measurement, stability to heat, and neutralization by *B. welchii* antitoxin.

Eosinophilia in parasitic infections. W. T. VAUGHAN (*Jour. Lab. and Clin. Med.*, 7 (1921), No. 2, pp. 123-126).—This discussion is based upon a review of the more recent investigations of the subject.

Vaccination against bovine hemorrhagic septicemia with attenuated virus. F. D'HÉRELLE and G. LE LOUET (*Ann. Inst. Pasteur*, 35 (1921), No. 11, pp. 741-744).—Data are presented showing that the virus of bovine hemorrhagic septicemia attenuated by repeated passage through rabbits is capable of producing a lasting immunity in cattle or buffaloes. This virus can be preserved unchanged in macerated rabbit tissue, but if kept in macerated beef tissue it apparently regains its virulence so that fatal results are obtained following inoculation.

Pyosepticemic infections in newborn animals. L. C. MAGUIRE (*Vet. Jour.*, 77 (1921), No. 555, pp. 334, 335).—The author claims to have eradicated white scours from eight dairy farms having a total of 112 cows by treating the pregnant cows with a vaccine prepared from an affected animal on the same farm. The vaccination, which is carried out in the seventh and eighth month of pregnancy, consists of three injections at intervals of 10 days, the first injection containing 10,000,000, the second 25,000,000, and the third 50,000,000 dead bacilli. One week after birth each calf receives an injection of one-fourth the initial dose of vaccine employed for the cows.

On the probable identity of the Chittenden-Underhill pellagra-like syndrome in dogs and blacktongue. G. A. WHEFLER, J. GOLDBERGER, and M. R. BLACKSTOCK (*Pub. Health Rpts [U. S.]*, 37 (1922), No. 18, pp. 1063-1069).—Attention is called to the striking similarity between the blacktongue disease of dogs and the pellagra-like syndrome produced by Chittenden and Underhill in dogs by feeding a diet of boiled peas, cracker meal, and cottonseed oil (*E. S. R.*, 38, p. 366). A review of the literature on blacktongue is given, together with post-mortem findings in two cases. It is suggested that further investigation of this disease in dogs and a trial of the efficacy of a strictly dietary treatment are of importance on account of the probability that blacktongue in dogs may prove the analogue of pellagra in man.

Contribution to the study of the diagnosis of tuberculosis. W. FORNET (*Ann. Inst. Pasteur*, 35 (1921), No. 11, pp. 797-800, fig. 1).—The author subjects cultures of tubercle bacilli to be used for the agglutination test to six or eight hours' extraction in a modified Soxhlet apparatus with ether vapor, which is said to dissolve the waxy envelope surrounding the bacilli. The apparatus is so constituted that only the vapor of the ether comes in contact with the organism.

Cowpox and sheep pox. J. BRIDÉ and A. DONATIEN (*Ann. Inst. Pasteur*, 35 (1921), No. 11, pp. 718-740).—The authors review the conflicting literature on the relationship between sheep pox and cowpox, and report a series of experi-

ments undertaken to solve the question of the identity of these diseases. The conclusions drawn from the investigation are as follows:

Sheep can be inoculated with cowpox virus and can be used for the production of cowpox vaccine. Inoculation of vaccine (cowpox) protects sheep against a new inoculation of the vaccine provided the first inoculation has been followed by a satisfactory reaction. Vaccination against cowpox does not immunize sheep against sheep pox, nor does vaccination against sheep pox immunize sheep or other animals against cowpox. These results are thought to indicate that the virus of cowpox and sheep pox are not identical. Several references to the literature are appended.

Some observations on the digestive system of the fowl, T. G. BROWNE (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 1, pp. 12-32).—The experiments conducted by the author have led to the following conclusions:

"When the contents of the large intestine and the feces have been of a moderately dry character for some time the caecal contents, when present, are found to consist of a characteristic, homogeneous, almost chocolate-colored, pulaceous material, always free from sand and grit. If the contents of the large intestine and the feces have been semifluid in character for some time the caecal contents also become semifluid and almost indistinguishable from those in the large intestine. A portion at least of the characteristic pulaceous material present in the caeca remains in these tubes for as long as 48 hours. The caeca are occasionally found empty.

"Fluid or semifluid material in the caeca remains here for only a short time, being soon evacuated and immediately replaced by fresh material. The proportion of ingesta passing through the caeca varies directly with the fluid condition of the contents of the large intestine. Usually a considerable proportion of the intestinal contents does not enter the caeca. Only fluids are allowed to enter the caeca, and if these fluids are colored the stain only very slowly mixes with the pulaceous caecal contents when present, at first staining only the surface of this material.

"The rate at which fluids pass along the caeca varies directly with the quantity passing through the intestine. The time required for fluids given orally to reach the blind extremities of the caeca varies from one and a half to four hours, according to the quantity administered. If mixed with food they require longer than if drenched as fluid. In the majority of cases colored material given by the mouth will reach the blind extremities of the caeca at about the same time as it first appears in the feces. Colored material given orally may occasionally appear in the feces before it has entered the caeca, particularly if for any reason it has been hurried along the intestine with unusual rapidity. Fluids injected through the cloaca into the large intestine under slight pressure will reach the blind extremities of the caeca almost immediately, and in many cases none of this fluid is allowed to pass forward in the intestine beyond the caecal valves.

"In the treatment of parasitic affections of the caeca parasitocides given by the mouth must necessarily undergo a very high degree of dilution before reaching the caecal openings, and, when this is considered in conjunction with the probability that a large proportion of these agents may escape the caeca altogether, there appears to be no doubt that a much more effective method of treatment would be to inject these agents through the cloaca by means of a syringe or other suitable instrument."

Poultry diseases and their remedies, J. G. BLAIR, rev. by D. D. CAVANAUGH (*Springfield, Ohio: A. D. Hosterman Co., 1922, rev. and enl. ed., pp. 100, pl. 1, figs. 24*).—This is a popular account.

A study of poultry diseases, W. C. THOMPSON and L. S. DODSON (*New Jersey Stas. Bul.* 363 (1922), pp. 61, figs. 19).—During the past 8 years 61 different poultry diseases have come to the attention of investigators in the department, and during the last 6 years, when accurate clinical records were kept, 2,135 cases have been examined in the laboratory. The authors consider the diseases which they deem to be of greatest practical and economic importance in New Jersey, and classify and discuss the common causative agencies of poultry diseases.

In order that the poultryman may more thoroughly appreciate the serious effects of the chicken pox, roup, and canker group of diseases, the department's campaign against them is outlined and discussed. In the last part of the bulletin 20 of the most serious diseases of chickens outside this group are discussed in detail.

Active immunization against fowl cholera, R. MANNINGER (*Deut. Tierarztl. Wchnschr.*, 29 (1921), No. 43, pp. 543-545; *abs. in Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 1, p. 72).—The author reports satisfactory results in the active immunization of fowls against fowl cholera by the use of a vaccine prepared from a culture of an avirulent strain of fowl cholera bacillus. The vaccine is prepared by washing off the growth in agar cultures into sterile physiological salt solution, the suspension being of such a concentration that each cubic centimeter contains 5 mg. of bacteria. For hens this vaccine was given in 1-cc. doses and for ducks, geese, and turkeys in 2-cc. doses, a single inoculation being given.

The immunity thus secured is said to last for from six weeks to over four months. Losses following vaccination appear to depend largely on the time of vaccination with reference to the appearance of the disease in the flock. In flocks in which there has been a loss of 30 per cent or over before vaccination not much can be hoped for from the vaccination. In such cases it is considered advisable to give a preliminary serum treatment, followed in a few days by the vaccine.

The care of rabbits in health and disease, S. LOCKETT (*Nev. Agr. Col. Ext. Bul.* 29 (1922), pp. 23-34).—This is a summary of information on the parasitic and infectious diseases to which rabbits are subject and means for their control.

RURAL ENGINEERING.

The border method of irrigation, S. FORTIER (*U. S. Dept. Agr., Farmers' Bul.* 1243 (1922), pp. 41, figs. 34).—This bulletin describes the border method of irrigation, gives practical information as to its proper use, and describes practice in Arizona, Nevada, Oregon, Idaho, California, and southwestern Texas. It is stated that a smooth, regular surface having a slope in one direction of about 2.5 in. to the hundred feet may be regarded as ideal for the border method of irrigation. The most favorable soil for borders is a free-working loam several feet deep, underlaid by a more or less impervious subsoil.

Considerable tabular working data are presented, together with diagrammatic illustrations and descriptions of necessary structures and equipment. Methods of preparing the land for border irrigation are also described.

A proposed uniform law for land reclamation by drainage, J. A. HARMAN (*Engin. News-Rec.*, 88 (1922), No. 17, pp. 692-699).—This article outlines the current situation as regards drainage laws, states the requirements of an ideal law, and gives an explanation and complete digest of a suggested general drainage law for State enactment.

Hydraulics of pipe lines, W. F. DURAND (*New York: D. Van Nostrand Co., 1921, pp. XVI+271, figs. 134*).—This is one of the Glasgow series of textbooks of civil engineering, edited by G. Moncur. It gives a technical discussion of the more important hydraulic problems which arise in connection with pipe lines and pipe-line flow. Chapter 1 presents briefly the elementary principles relating to pipe-line flow, with some special emphasis on pipe friction and secondary losses due to miscellaneous turbulence. Chapter 2 deals with surge and chapter 3 with the analytical details of water ram or shock. Chapter 4 discusses stresses in pipe lines due either to static pressure or conditions of flow. Chapter 5 presents descriptive and structural material relating particularly to materials of construction, joints, fittings, fastenings, etc. Chapter 6 discusses briefly pipe lines for the conveyance of viscous fluids.

History of wood pipe and some data on its use, E. J. BARTELS (*Amer. Wood Preservers' Assoc. Proc., 17 (1921), pp. 369-381, figs. 3*).—The history of wood pipe for the conveyance of water is briefly reviewed, and data on its use for the conveyance of water for water supply and for irrigation are presented and discussed.

Iodin and arsenic in subterranean waters, F. RICHERT and R. A. TRELLES (*Rev. Facult. Agron. y Vet. Buenos Aires, 3 (1921), No. 3, pp. 285-287*).—Chemical analyses of samples of 15 different subterranean water supplies from the plains country of Argentina to determine their content of iodine and arsenic are reported and briefly discussed.

It was found that iodine and arsenic are constant elements in the waters of the plains formations. The content in these two elements is intimately related to the chemical composition of the water and to the natural geology of the soil. When the waters increased in temporary hardness the concentration in iodine and arsenic increased. On the other hand, waters containing permanent hardness were poor in these elements. Waters from granitic or calcareous soils were also poor in iodine and arsenic.

Purification and sterilization of water by means of lime in connection with the supply of drinking water in the Dutch East Indies, J. SMIT (*Meded. Geneesk. Lab. Weltevreden [Dutch East Indies], 3, Ser. A, No. 5-7 (1920), pp. 126-161*).—In the first report (appearing in both the Dutch and English languages) laboratory experiments on the use of lime for water purification, conducted at the Medical Laboratory at Weltevreden, Java, are reported. The results are taken to indicate that lime may be used with advantage in the preparation of drinking water that is above the suspicion of impurity.

Purification of water with lime, II, J. SMIT (*Meded. Burgerl. Geneesk. Dienst, Nederland, Indië, No. 2 (1921), pp. 111-189, pl. 1*).—In a second contribution to the subject, experiments conducted on a larger scale than those noted above are reported.

Treatment of water with quicklime at a rate of about 200 mg. per liter, followed by filtration through a sand column 80 cm. high, produced a clear water even from dirty water. The bacterial counts of this filtrate were very small, and the reduction in numbers of coli bacteria was marked. The cholera and typhoid bacteria were entirely eliminated. It is concluded that the action of the quicklime due to its high alkalinity is much more marked than that of aluminum. The alkaline water is neutralized by a small amount of carbon dioxide or by thorough aeration.

Purification of water with lime in connection with the drinking water question in the Dutch East Indies, J. SMIT (*Centrl. Bakt. [etc.], 2, Abt., 53 (1921), No. 13-14, pp. 273-284*).—This is an abridged report of the studies noted above.

Highway researches and what the results indicate, A. T. GOLDBECK (*Good Roads*, 62 (1922), Nos. 16, pp. 223-226, 228-230; 17, pp. 233-238, figs. 21).—A summary is given of the results obtained to date in the research on highway problems being conducted by the Bureau of Public Roads, U. S. D. A. Special attention is drawn to the results of studies of impact on roadway surfaces and subgrade and drainage investigations. Attention is drawn to the lack of knowledge of fundamental principles, and emphasis is placed on the importance of planning highway research with a view to establishing such principles.

[Report of the division of highways and the registry of motor vehicles], J. N. COLE (*Mass. Dept. Pub. Works Ann. Rpt. 1920*, pp. 148, pls. 5).—This report deals with the work and expenditures of the division of highways of the Department of Public Works of Massachusetts for the year ended November 30, 1920, and gives data on the registry of motor vehicles in the State for that period.

The suitability of certain Indian woods for hammer handles, L. N. SEAMAN (*Indian Forester*, 48 (1922), No. 4, pp. 175-180, pls. 2).—Static and impact bending tests of four species of Indian woods in both the air seasoned and steam seasoned conditions to determine their suitability for use in hammer handles are reported. The specimens were made up into standard 24-in. handles of about 1½ in. by 1½ in. cross section at their smallest part and tested on a span of 19 in., bringing the smallest section close to the center of the span where the load was applied.

Of the species tested, *Anacardium latifolia* appeared to be at least the equal of *Olea ferruginea* for tool handles. It was not so stiff, but was decidedly tougher under steadily applied loads and of about the same toughness when subjected to impact stresses. *Schleichera trijuga* and *Terminalia tomentosa* were somewhat inferior to *O. ferruginea* for tool handles, falling somewhat below that wood in their ability to resist shock. Under a steady load they were tougher and were not so stiff.

It was found that steam seasoning had no undesirable effect on the material used for hammer handles. With one exception the variations were extremely small. The results are taken to indicate the suitability of all four species for tool handles, and more especially *A. latifolia* and *O. ferruginea*.

Results of some tests of the effect of zinc chlorid on the strength of wood, T. R. C. WILSON and E. BATMAN (*Amer. Wood Preservers' Assoc. Proc.*, 17 (1921), pp. 80-88, figs. 11).—In a contribution from the Forest Service, U. S. D. A., studies on the effect of zinc chlorid on the strength of Douglas fir, longleaf pine, and a small amount of spruce pine are reported. The test specimens were 2 in. by 2 in. by 4 ft. They were treated with dry zinc chlorid at rates of 0.25, 0.5, 0.75, and 1 lb. per cubic foot. The tests were conducted four months, one year, and five years subsequent to treatment, and included static bending, impact, compression-parallel-to-grain, compression-perpendicular-to-grain, tension-perpendicular-to-grain, and hardness tests.

It was found that for a short time subsequent to treatment there was a relation between concentration of preservative in the wood and strength properties, but that later changes took place which modified this relation. The effect of the preservative very largely disappeared with some properties, such as modulus of elasticity and maximum crushing strength. In other cases, such as those test values which indicate resistance to shock, the effect of the lighter concentrations increased, and there was a fairly definite indication of permanent and possibly increasing deteriorating effect.

The effect of the zinc chlorid process of preservation on the strength of structural timber, H. B. LUTHER (*Amer. Wood Preservers' Assoc. Proc.*, 17

(1921), pp. 89-114, figs. 18).—Experiments conducted at the Massachusetts Institute of Technology on the effect of preservative treatment with zinc chlorid on the strength of loblolly sapwood are reported. The specimens used were 2 by 2 by 30 in., and the treatment was made by immersion in a cold solution. The specimens were stored in a group at room temperature and in ovens at temperatures of 100 and 150° F. They were tested at periods varying from three months to two years in direct compression and in cross bending.

No appreciable difference in strength was observed between treated and untreated timbers which had been stored at room temperature. A decrease of 3.5 per cent in compression strength parallel to the grain and of 17.6 per cent in cross bending strength was observed with specimens stored at 100°. A decrease of 20.6 per cent in compression strength parallel to the grain and of 49 per cent in cross bending strength was observed for specimens stored at 150°.

The conclusion is drawn that zinc chlorid, when used as a preservative, decreases the strength of timbers subjected to relatively high temperatures, and that this deteriorating effect is likely to be very marked under extreme conditions of heat and is continuous for several years. There is considered to be a safe temperature below which the effect of zinc chlorid is negligible, which is thought to be somewhat higher than 75° and less than 100°.

Quantity of wood treated and preservatives used in the United States in 1920. R. K. HELPHENSTINE, JR. (*Amer. Wood Preservers' Assoc. Proc.*, 17 (1921), pp. 546-567, figs. 10).—This is a contribution from the Forest Service, U. S. D. A., made in cooperation with the American Wood Preservers' Association. It states that a total of 173,309,505 cu. ft. of wood was subjected to preservative treatment in the United States in 1920, which represented an increase of 18 per cent over the amount treated in 1919. In this work 68,757,508 gal. of creosote, 1,848,911 gal. of paving oil, 49,717,929 lbs. of zinc chlorid, and 1,772,084 gal. of miscellaneous preservatives were used.

Service tests of treated and untreated fence posts. J. D. MACLEAN (*Amer. Wood Preservers' Assoc. Proc.*, 17 (1921), pp. 401-424, fig. 1).—The results of a series of experiments conducted by the Forest Service, U. S. D. A., in cooperation with a number of the State agricultural experiment stations, on the durability of treated and untreated fence posts are reported. With a few exceptions, most of the posts treated at the experiment stations averaged from 5 to 6 in. in diameter and from 6.5 to 7.5 ft. in length. Most of them were treated in the round form. A large proportion of the treated posts had been in service from 10 to 12 years at the time of the last inspection.

It was found that the durability of the posts, whether treated or untreated, is influenced by a number of factors, such as species, method of seasoning, size of post, proportion of heartwood and sapwood, shape, and soil and climatic conditions.

Radial penetration was found to be of prime importance, and a good absorption was not always an indication of satisfactory treatment. Some species, such as basswood, bay, cottonwood, poplar, and willow, appeared to take heavy absorptions, due to end penetration, but were very difficult to penetrate radially. This is taken to indicate the importance of securing the best possible radial penetration at the ground line and of the thorough treatment of both tops and butts, especially the tops of posts of nondurable species. The superiority of treatment of the entire post over butt treatment only was very marked. Butt treatments are apparently more suitable for posts of the durable woods in the

split form or where they have very little sapwood. Brush treatment increased the life of the posts, but was very inferior to the open tank method. Charring posts seemed to be of very little value as a protection against decay.

The order of merit of the nonpressure treatments employed, beginning with the most satisfactory method, was as follows: (1) Open tank treatment of the entire post in creosote oil, with butts treated in a hot bath, followed by a cold oil bath for the entire post; (2) hot and cold bath butt treatment with coal-tar creosote; (3) cold oil bath only with coal-tar creosote; and (4) brush treatment with coal-tar creosote.

Water-gas tar apparently possesses preservative qualities, but the importance of selecting a water-gas tar of good quality is emphasized. Crude oil by itself seemed to be very unsatisfactory for post treatment on account of its low toxic value and the difficulty of obtaining a good penetration. The good results secured with the use of crude petroleum and with water-gas tar for the hot bath are taken to indicate the practicability of substituting a cheaper oil for the heating medium when creosote is employed for the subsequent cold bath.

The results of the experiments in various sections of the country showed that posts decay much more rapidly in the Southern States than they do in the North. The open-tank method of treatment seemed to be entirely satisfactory for fence posts, provided they were properly prepared and a suitable preservative used.

Analyses of several oils used in the experiments are included.

Action of alkali salt on Portland cement mortars, D. G. MILLER (*Engin. and Contract.*, 57 (1922), No. 15, pp. 359, 360, fig. 1).—Studies conducted under a cooperative agreement between the U. S. Department of Agriculture and the University of Minnesota on the influence of magnesium sulphate on Portland cement concrete are reported.

Test cylinders of concrete made of standard Ottawa sand and of screened and pit-run Minnesota sand were immersed in solutions containing 1, 2, 4, and 8 per cent of magnesium sulphate. It was found that the concrete highest in quality, as indicated by strength and absorption, best withstood the deleterious action of magnesium sulphate.

Original improvement in windmills, M. CONTI (*Rev. Facult. Agron. y Vet. Buenos Aires*, 3 (1921), No. 3, pp. 294–306, figs. 5)—Studies conducted at the Experimental Institute of Mechanical Agriculture of Argentina are reported, which resulted in the development of an improved windmill adapted for the operation of a vertical double-acting plunger pump. The essential features of this apparatus are back gearing fitted with two sets of cranks, each operating a plunger rod, one contained within the other. This permits the simultaneous operation of two plungers within a single cylinder, moving in opposite directions and both acting as suction and forcing plungers at alternate periods.

Tests of the capacity of this apparatus showed that at a speed of as high as 22 strokes per minute the amount of water pumped was increased about 60 per cent over the amount pumped by ordinary single-acting apparatus.

Tests with an absorption dynamometer to determine the power development and consumption of such an outfit are also briefly reported.

Recent research work on the internal-combustion engine, H. R. RICARDO (*Jour. Soc. Automotive Engineers*, 10 (1922), No. 5, pp. 305–336, 347, figs. 42).—The author describes the research work on the internal combustion engine conducted recently in his laboratory in England, and presents his deductions therefrom, based upon an analysis of the evidence obtained to date. Fuels are discussed at length under the headings of detonation, latent heat of evaporation, and mean volatility.

It has been found that detonation has very little connection with the temperature of compression, but is closely dependent upon the compression pressure. It is concluded that the pressure controls the initial rate of burning and therefore the tendency to detonate. The influence of the nature of the fuel upon detonation is discussed, including comment upon the benefits derived from using weak fuel mixtures. Turbulence is also discussed with reference to combustion chamber design.

The paper is supplemented by nine appendixes which include discussions of mechanical efficiency, piston experiments, air measurement, the total internal energy of the working fluid over a wide range of temperature, the influence of compression ratio upon power output and efficiency, the influence of cylinder size upon performance, the influence of cylinder temperature upon power output, the distribution of heat in a high speed internal-combustion engine, and the efficiency of a single-cylinder engine under reduced loads.

Oils, fats, and fuels, T. HUN (London, Glasgow, and Bombay: Blackie & Son, Ltd., 1921, pp. VIII+143, pls. 8, figs. 22) —This is a hand and text book dealing with oils, fats, fuels, and lubricating oil. The main portion of the book is devoted to mineral or rock oils, petroleum products, artificial mineral oils, technology of oils and fats, lubricants, and fuels. Considerable discussion of the properties, combustion, calorific values, and general uses of liquid fuels, especially in internal-combustion engines, is presented.

The improvement of the lubricating properties of mineral oils, J. H. HYDE (*Engineering* [London], 111 (1921), No. 2893, pp. 708, 709, figs. 10; *abs. in Sci. Abs., Sect. B—Elect. Engin.*, 24 (1921), No. 286, pp. 486, 487) —Studies conducted at the National Physical Laboratory of Great Britain on the influence of adding fatty acids to mineral oils are reported. Tests were conducted with mixtures of mineral oil with varying percentages of (1) rape oil containing 2.44 per cent of free fatty acids, (2) neutral rape oil, (3) rape oil fatty acids, and (4) the best commercial oleic acid. A Deely testing machine was used, consisting essentially of two opposing friction surfaces, the lower in the form of a disk and the upper consisting of three pegs equally spaced in a circle on the under side of a rotating carriage. The pressure between the two surfaces is varied by loading the carriage with suitable weights. Readings were taken at loads corresponding in intensities to the pressures of 20, 40, 60, 80, 100, and 120 lbs. per square inch.

The coefficient of friction was found to be constant in most cases over the range of loads tested. A very considerable reduction in the value of the static coefficient of friction of the mineral oil was effected by the addition of as little as 0.1 per cent of fatty acid, whether added as pure oleic acid, acid rape oil, or as rape oil fatty acids. Of the three methods tried, the addition of the rape oil fatty acids proved the most effective in this respect.

Increase in the proportion of rape oil produced further decrease in the coefficient of friction, and the value obtained for the 8 per cent mixtures (0.2 per cent acidity) was 0.099, for the 20 per cent mixture (0.5 per cent acidity) 0.093, and for the 40 per cent mixture (1 per cent acidity) 0.087. The coefficient given by the rape oil alone was 0.081. The addition of pure oleic acid in place of the rape oil gave very similar results.

The results obtained by the addition of the rape oil fatty acids showed a greater reduction in the friction than those of the rape oil and oleic acid mixtures. The value was reduced from 0.132 to 0.087 by the addition of only 0.2 per cent of rape oil fatty acids, but a similar reduction required 40 per cent of rape oil (acidity of mixture 1 per cent), 2 per cent of oleic acid, or 85 of neutral rape oil. Repeat tests were made on the straight mineral oil and on

the acid rape oil at the conclusion of the experiments, and the results agreeing within 2 per cent of the original values were obtained. An apparent variation of the results with time is noted, which is being further studied.

Comparative studies were conducted on the Daimler-Lanchester worm gear testing machine using mixtures of mineral oil with oleic acid. The pure mineral oil gave an efficiency of the gear of about 96 per cent, corresponding to a coefficient of friction of 0.02. When sufficient oleic acid was added to make a mixture of 0.2 per cent acid, the efficiency was raised to 96.4 per cent and the coefficient of friction reduced to 0.018. After cooling, more acid was added, bringing the mixture up to 2 per cent acidity. The gear then gave an efficiency of 96.6 per cent, corresponding to a coefficient of friction of 0.017. Pure rape oil gave a constant efficiency of 96.7 per cent or a coefficient of friction of 0.0165.

Annual report of the agricultural engineering department, U. C. CORBELL (*Mississippi Sta. Rpt., 1921, pp. 42, 43*).—Preliminary tests to observe the practicability and limitations of tractor work under southern conditions are reported. The field selected was prepared for corn and all operations, including plowing, disking, harrowing, planting, and cultivation, were done by power farming implements operated by a 10-20 h. p. tractor. The test indicates the great need of proper drainage and proper shaping of fields in order that tractor and motor cultivation may be used successfully.

A test of saving hay with motorized outfits showed that 75 per cent of the labor can be eliminated in haying operations by the use of tractors and motors, and the time reduced at least 50 per cent. Further results indicated that by using the side delivery rakes less time is consumed in loading hay and better color and higher quality is obtained.

Construction and use of homemade implements for summer tillage, A. J. OGAARD and H. E. MURDOCK (*Mont. Agr. Col. Ext. Circ. 47 (1921), pp. 8, figs. 4*).—This circular has been prepared to answer inquiries regarding the construction and use of homemade tillage implements designed for effective summer tillage, more especially under the dry farming conditions of Montana. These include the sled knife, gooseneck, rod, and double rod types of weeder. It has been found that the power required for these weeders varies greatly with the nature and condition of the soil and with the condition of the weeder if of the knife type. For average conditions it is stated that one horse will be able to pull about 2 ft. of length of the rod type and 3 ft. of the knife type.

Chimney construction, L. M. EMMER (*Dom. Engin., 99 (1922), No. 4, pp. 140-143, figs. 9*).—Information and drawings on the construction of chimneys for dwellings are presented in this article. Tabular data on chimney sizes and heights and grate areas are also included.

Sewerage and sewage treatment, H. E. RABBITT (*New York: John Wiley & Sons, Inc., 1922, pp. XII+531, figs. 186*).—This book presents an exposition of the principles and methods for the designing, construction, and maintenance of sewerage works and for the treatment of sewage. Special stress is laid on the fundamentals of the subjects rather than the details of practice. Chapters are included on work preliminary to design; quantity of sewage; hydraulics of sewers; design of sewerage systems; appurtenances; pumps and pumping stations; materials for sewers; design of the sewer ring; contracts and specifications; construction; maintenance of sewers; composition and properties of sewage; disposal by dilution; screening and sedimentation; septicization, filtration and irrigation; activated sludge; acid precipitation, lime and electricity, and disinfection; sludge; and automatic dosing devices.

RURAL ECONOMICS AND SOCIOLOGY.

Annual report of the farm management department, J. N. LIPSCOMB (*Mississippi Sta. Rpt. 1921, pp. 40, 41*).—Summaries of the year's business on 160 farms in Jones County, Miss., taken during the winter of 1919-20, have been analyzed. From this preliminary report it is indicated that those farms which had 16 per cent of the crop land in cotton made a larger labor income than farms which had a greater or less amount. The average for the 160 farms was 31.5 per cent. The average of crop land in corn was 44.5 per cent, but farms having only 12.2 per cent in this crop made the largest labor income. The labor income was also directly proportional to the amount of crop land in oats, the farm having the largest having 26.5 per cent, while it increased with the lespedeza acreage up to about 15 per cent of the crop land. The group of farms which had an average of 92.6 per cent of the productive animal units in cattle made the largest labor income, and this decreased as the percentage of the animal units in swine was increased.

Royal Agricultural Society's farm competition, H. A. MULLETT (*Jour. Dept. Agr. Victoria, 18 (1920), No. 8, pp. 449-480, figs. 25*).—An inspection of 10 farms qualified for entry in this competition took place in March, 1920, and scores were drawn up on a scale of crops and stock 100 points; machinery, buildings, and plant 100; and the farm as a business and a home 100, making a possible total of 300 points. The individual farms are described in the judges' report, and an analysis is made of the farm business on each.

The average farmer in this, the Wimmera district of Victoria, has a capital of from £5,000 to £15,000 invested in his farm. The difference between the revenue and the expenditure on each farm was obtained for each year, 1916-17, 1917-18, and 1918-19, inclusive, from copies of the Federal income tax returns, and the average annual profits were determined. Based on the returns for the three years, it is reported that each competitor earned 5 per cent on his capital, the sums ranging from £60 to £820 in addition.

It appeared that the labor income from most of the farms where wheat was the principal crop was generally better than that from farms where sheep raising was the principal industry. Labor incomes were best from the high-priced fertile land, and high average yields of wheat were an important factor determining labor income.

Report on investigations relative to the profits of agriculture in Switzerland in 1918-19 and 1919-20, E. LAUR ET AL. (*Ann. Agr. Suisse, 22 (1921), No. 6, pp. 369-431; also in Landw. Jahrb. Schweiz, 35 (1921), No. 4, pp. 341-459*).—The data on which a preliminary report was published earlier (E. S. R., 46, p. 591) are presented here in detail.

The business organization of and returns from beekeeping in 1920 (*Landw. Jahrb. Schweiz, 35 (1921), No. 4, pp. 461-479*).—A total of 540 records kept yearly from 1912 to 1920, inclusive, are analyzed, showing the capital investment, expenses, and returns of beekeeping in Switzerland.

Simple farm accounts, R. E. WILLARD (*Fargo, N. Dak.: Author, 1922, pp. 106, fig. 1*).—The various accounts deemed essential for determining the facts concerning the farm business are grouped under the five general headings of capital investments, expenses, receipts, summaries, and measures of farm business, including size of farm, acreage in crops, amount of labor expended, number of work horses and milch cows, crop yields, live-stock receipts, the value of machinery per crop acre, number of crop acres per horse, and values of man labor per crop acre. Illustrative entries from an actual farm are shown.

The change since the war in value of the principal items of farm investment, W. ROTHKEGEL (*Deut. Landw. Presse, 48 (1921), Nos. 26, pp. 197, 198*;

27, pp. 205, 206, fig. 1).—It is pointed out here that in 1894 on Prussian estates of over 100 hectares (247 acres) the proportions of investment were for the land between 57 and 73 per cent, for buildings from 24.5 to 15 per cent, and for miscellaneous stock and equipment between 18.5 and 12 per cent. The averages for the State as a whole were 64, 5, 19.5, and 16 per cent, respectively. These percentages are said to have undergone radical changes during recent years as a result of increased prices for machinery, live stock, and buildings, and the fact that bare-land values have changed only slightly.

Figures from a farm of 800 hectares in Brandenburg are cited in illustration. On January 1, 1914, the investment in dead inventory as distinguished from live stock amounted to 4 per cent, that in live stock 11, buildings 26, and bare land 59 per cent. By January 1, 1921, there had been an increase in prices of cultivating tools and machinery of 1,160 per cent, of equipment for cattle of 800, and of sheep and swine of between 930 and 700 per cent. Prices for other kinds of farm and farm home equipment increased similarly. Present proportions of the total market value of the estate in question of dead inventory are said to be 12 per cent, live stock 47.6, bare land 22.4, and buildings 18 per cent.

Seedtime and harvest: A graphic summary of seasonal work on farm crops, O. E. BAKER, C. P. BROOKS, J. R. COVERT, and R. G. HAINSWORTH (*U. S. Dept. Agr., Dept. Circ 183 (1922), pp. 53, figs 69*).—A revision of the Yearbook article noted earlier (*E. S. R.*, 39, p. 495).

Suggestions for a law modifying the terms of farm leases, E. VAN DIEVOET ET AL. (*Rev. Gén. Agron., n. ser., 12 (1922), Nos. 1, pp. 18-23; 2, pp. 33-48*).—Measures for guaranteeing freedom to the French renter in the matter of selection of crops, greater security for the farm tenant, certain privileges for the lessee, and the destruction of rabbits are drawn up.

Agricultural and live stock conditions and finance, E. MEYER, JR. (*Washington: War Finance Corporation, 1922, pp. 12*).—Observations and recommendations with reference to credit conditions for agriculture and the live-stock industry west of the Mississippi River in the spring of 1922 are submitted in this report to the President.

Prosperity and debt in the Punjab, M. C. DARLING (*Agr. Jour. India, 16 (1921), No. 2, pp. 176-193*).—Throughout the period 1903-1917 the mortgage indebtedness in this Province in India is found to have increased steadily. This tendency is accounted for on the basis of peculiar conditions in districts where it was most noticeable, and seven general explanations of indebtedness are noted as bad seasons, increase of population without a corresponding increase in production, expansion of cultivation, splitting up of holdings, purchase of land on credit, high prices, and facile credit. Two remedies are suggested—one improvement in agricultural methods so that production may keep pace with population, and the other the encouragement of emigration.

Investigations of methods of calculating agricultural wages, L. W. RIES (*Landw. Jahrb., 56 (1921), No. 2, pp. 169-242*).—In the first section of this paper the author analyzes in detail the separate phases of the agricultural business which give rise to different methods of calculating wages. In the second he discusses the piece wage, bonuses, share wages, and wages in kind, and the peculiar tasks which demand different kinds of payment, including also colony and group work in agriculture. Measures of accomplishment, as, for instance, piecework finished, area covered, raw or other materials used, and others are minutely described.

Farm organizations (*U. S. House Represent., 66. Cong., 3. Sess., Com. Banking and Currency, Hearings on Farm Organizations, 1922, pp. 344, figs. 2*).—Details of the purpose, organization, and activities of the American Farm Bureau

Federation are brought out in hearings in 1921 on a plan to have the Government directly finance the export of farm staples to Europe and assume all the responsibility therefor.

Cooperative farm marketing organizations in California and what they have accomplished (*Mo. Rev.*, 1922, Apr.; also in *Econ. World*, n. ser., 23 (1922), No. 18, pp. 619-623).—A summary is given of operations in recent years of a number of growers' cooperative marketing organizations.

Report on the Winnipeg Grain Exchange ([*Winnipeg: Royal Grain Inquiry Comm.*], 1921, pp. 46, figs. 12).—This is a statement submitted in response to a questionnaire received May 16, 1921, inquiring about the date of formation, division of membership, annual financial statements and reports, prices of membership certificates, annual fees or assessments on each membership, official records kept of trading done each day affecting cash grain and futures, futures market restriction or censorship, and any other trading permitted.

Wool marketing through regional pools, J. McDANIEL and D. C. ROGERS (*Missouri State Bd. Agr. Mo. Bul.*, 19 (1921), No. 10, pp. 55, figs. 13).—A detailed description of the organization, management, and operation of a regional wool pool organized in northwest Missouri in 1920 is given.

Cooperative wool marketing in Missouri, J. R. CAVANAGH and D. C. ROGERS (*Missouri State Bd. Agr. Mo. Bul.*, 18 (1920), No. 10, pp. 5-33, fig. 1).—A general account is given of wool pooling, grading, and marketing in Missouri since about 1905.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul.*, 9 (1922), No. 50, pp. 8).—A partial list of products which farmers have for sale is given, together with a brief note on cooperative marketing of hogs in North Carolina.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul.*, 9 (1922), No. 51, pp. 8).—Southern farmers are urged to adopt a self-sufficing plus commercial crop system of farming and to establish more cooperative credit and banking institutions. The usual partial list of products which farmers have for sale is given.

Report of the National Agricultural Conference (*U. S. House Represent.*, 67, Cong., 2, Sess., Doc. 195 (1922), pp. 1-200).—This report of the conference held in Washington, D. C., January 23-27, 1922, embodies the address by the President and the Secretary of Agriculture, reports of committees and resolutions, and other business of the conference, as well as addresses, as follows: Agricultural Prices and the Present Situation, by S. Anderson; Agricultural Conditions in the Northeastern States, by E. B. Cornwall; The Agricultural Situation in the Cotton Belt, by J. W. Morton; Agricultural Conditions in the Corn Belt, by A. Sykes; Agricultural Conditions in the Spring-wheat Area, by J. H. Hagan; Agricultural Conditions in the Range Country, by F. H. Bixby; The Effect of the Agricultural Depression on the Implement Industry, by W. H. Stackhouse; The Effect of the Agricultural Depression on the Milling Industry, by J. F. Bell; The Effect of the Agricultural Depression on the Meat-packing Industry, by T. Wilson; The Effect of the Agricultural Depression on the Fertilizer Industry, by C. H. MacDowell; The European Situation in its Relation to American Agriculture, by C. F. Warren; Financing Agriculture during the Emergency, by E. Meyer; The Financial Policy in its Relation to the Price Level, by W. C. Mitchell; Fundamentals of Cooperative Marketing, by G. H. Powell; The Place of the Independent Distributors, by W. L. Wagner; The Marketing of Cotton, by J. M. Parker; Cooperative Cotton Marketing, by C. Williams; Grain Marketing, by R. McDougal; Cooperative Marketing, by J. M. Anderson; The Need of a Food Supply for an Increasing Population, by E. D.

Ball; A National Forestry Policy, by G. Pinchot; A National Policy for Land Utilization, by R. T. Ely; A National Policy for Agricultural Research, by R. A. Pearson, noted editorially (E. S. R., 46, p. 301); and The Farm Woman and the Farm Home, by Mrs. C. W. Sewell.

The present and future welfare of the American farmer, J. I. FRANCE (*Cong. Rec.*, 62 (1922), No. 136, pp. 8254-8279).—Statistics compiled by W. W. Evans are published here, accompanying a speech in which the recent decline of American agriculture is attributed to the excessive production of foodstuffs in certain foreign countries, especially those having a depreciated currency. The statistics set forth the agricultural productions of the United States and foreign countries in pre-war and post-war periods; the normal and present value of currency in certain foreign countries; imports into the United States in 1913, with comparisons for later years, rates of duty on agricultural products imported into the United States, and imports and revenues for the periods 1911-1913 and 1919-1921.

Agriculture and the community, J. F. DUNCAN (*Queensgate, Stirling; Scot. Farm Servants' Union; London: Internatl. Bookshops Ltd., 1921, pp. V+119*)—It is held that the position of the three classes most directly concerned in English agriculture, the landowners, farmers, and farm workers, is unstable, and that many of the difficulties of British farming are created by the system of private property in land. Policies recently suggested, involving guaranteed prices, security of tenure, occupying ownership, and small holdings, are described and criticized. The author stresses the responsibility of the community for the advancement of the agricultural industry, and submits his suggestions for community control by the gradual elimination of inefficient landowners and farmers, the development of new methods of farming, and the improvement and reclamation of land suitable for agriculture.

The Agriculture Act, 1920, C. C. BLACK and E. WATSON (*London: Land Union, 1921, pp. IX+165*).—In this handbook are found the Agricultural Holdings Act of 1908, the Corn Production acts of 1917 and 1920, and others, with amendments and legislation covering minor matters, presented with cross references and notes.

Supplement to the handbook on the Agriculture Act, 1920, issued by The Land Union (*London: The Land Union, 1921, pp. [13]*)—Notes on later legislation than that treated in the above are given here.

Agricultural France and the war, C. CHALVEAU (*La France Agricole et la Guerre. Paris: Baillière, 1919, vol. 3, pp. VIII+250; 1921, vol. 4, pp. VIII+244, pls. 7*).—These volumes consist of collections of later articles by the author (E. S. R., 41, p. 294) on the subjects of the restoration of rural property in France, policies of wheat production and the bread supply, mechanical cultivation, forestry, animal production, colonial agriculture, and others.

The economic geography of the new States of Europe, P. CLERGEY (*Rev. Gén. Sci.*, 33 (1922), Nos. 4, pp. 111-120, figs. 2; 5, pp. 144-150, figs. 2).—New boundaries and economic resources of Austria, Hungary, Czechoslovakia, Yugoslavia, Rumania, Finland, Poland, Russia, and neighboring States are described.

Notes on the agriculture of Guadeloupe, M. RIGOTARD (*Agron. Colon.*, 6 (1922), Nos. 49, pp. 9-16, fig. 1; 50, pp. 47-54; 51, pp. 75-93, figs. 3).—The author describes the principal crops and live stock produced in this region.

Bases for the study of agricultural regions of Portugal and agricultural systems, J. I. PIMENTEL (*Bol. Min. Agr. [Portugal]*, 2 (1919), No. 2-6, pp. 3-71).—In this paper are given extracts from the literature descriptive of the agricultural regions of Portugal since about 1860, defining them and noting the soil and climatic conditions and flora and the size of the agricultural holdings.

The report of a mission to the districts of Castello Branco, Portalegre, Evora, Beja, and Faro, A. MELO (*Bol. Min. Agr. [Portugal]*, 2 (1919), No. 2-6, pp. 131-183).—Report is made of conferences held in these regions on the question of the organization of a statistical reporting service. Notes and tabulated data are included, showing prices, wages, principal crops, and crop yields by districts and minor subdivisions of Portugal, mainly for 1917 and 1918.

Report on a mission to the districts of Aveiro, Oporto, Braga, and Vianna do Castello, A. CASTILHO (*Bol. Min. Agr. [Portugal]*, 2 (1919), No. 2-6, pp. 185-205).—A report similar to the one noted above.

Report on the working of cooperative societies in Bihar and Orissa for the year 1920-21, M. AHMED (*Bihar and Orissa Coop. Soc. Rpt., 1920-21*, pp. [41]+29+XVII+3, pl. 1).—This report continues information previously noted (*E. S. R.*, 45, p. 594).

Prices and wages in India, D. N. GHOSH (*India Dept. Statis., Prices and Wages India*, 36 (1922), pp. [7]+246, figs. 2).—Statistical information previously noted for the earlier years (*E. S. R.*, 45, p. 205) is continued here.

Yearbook of figures of the live-stock trade, 1921 (*Chicago: Daily Drovers Jour.*, 1922, 21. ed., pp. 152).—Statistical compilations dealing with transactions in live stock, grain, provisions, and produce on the Chicago and other important markets are published here.

AGRICULTURAL EDUCATION.

Schools for farmers' sons—present deficiencies—future prospects, D. SNEDDEN (*Jour. Rural Ed.*, 1 (1922), No. 6, pp. 241-246).—The one-room rural school is deemed inadequate for the education of farmers' sons and daughters between 12 and 15 years of age. Furthermore, the attempt to vocationalize liberal education in the rural high school is criticized. The author advocates very practical vocational schools of farming of the home project type for boys from 15 to 19 or 20 years of age who continue to live on parental farms and rent therefrom land, live stock, and equipment necessary to honest, economically profitable, expertly supervised productive work as a major part of their vocational training. It is urged that the pupil should not attempt to get his working time vocational and liberal education simultaneously. The vocational and the liberal high school might use the same building, but should not have the same courses, books, library, laboratories, school hours, teachers, or principal.

Report of the director of elementary agricultural education [for New Brunswick], A. C. GORHAM (*New Brunswick Dept. Agr. Ann. Rpt., 1921*, pp. 8-14).—This report deals with school and home projects in nature study and agriculture for 1921.

Agricultural education and instruction [in St. Lucia] (West Indies Imp. Dept. Agr., St. Lucia Agr. Dept. Rpt., 1920, pp. 8-11).—Notes are included on the progress of a number of elementary schools in 1920.

Higher forestry education (Indian Forester, 47 (1921), No. 9, pp. 371-377).—A draft scheme of organization of an institution which would provide for the training of forest officers for the United Kingdom and from parts of the Empire having no place of higher training of their own, also review and special courses, is outlined. The committee favored the two main principles that the training be carried out at one central institution and that a necessary preliminary of this training be a complete university education. It recommends that existing university courses be coordinated and utilized as preliminary to such a higher course of training.

Some daily programs used in one-teacher schools (*Jour. Rural Ed.*, 1 (1921), No. 4, pp. 182-184).—There are presented here a three-division program devoted to occupations, social activities including competitive games, health education, local geography, and civics, and leisure activities (story-telling, silent reading, music, art, and dramatization) from a community school at McDonald County, Mo.; a daily program from a school at Johnson, Vt.; one from Quaker Grove, N. J., also on the three-group basis; and one of four divisions from Illinois arranged to allow for a plan of alternation.

Using community resources in the teaching of high-school agriculture, H. M. HAMLIN (*Jour. Rural Ed.*, 1 (1922), No. 7, pp. 320, 321).—The advisability of passing on to prospective farmers the best local practices of the community by class study of methods followed on the successful farms, also of bringing to their attention the activities of the local organizations, is suggested here.

Children's arithmetic problems, C. M. REINOEHL (*Jour. Rural Ed.*, 1 (1922), No. 5, pp. 215-221).—This is a collection of original problems based upon farm and home life submitted by children in the fifth to eighth grades, inclusive, in about 41 rural schools in Montana.

Home geography for rural schools, E. L. VAN SYCKLE (*Jour. Rural Ed.*, 1 (1922), No. 5, pp. 222-233).—A plan of work in home geography for the rural schools of Delaware is outlined by months from February to June. The aim of the course is to gain a clear understanding of the use of maps, to be able to read maps understandingly, and to know the industries and products of the county and of the State.

Report of the committee on lectures for a standard introductory course in field crops, W. C. ETHERIDGE and M. L. FISHER (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 128-136).—This report, presented at the meeting of the American Society of Agronomy at New Orleans on November 8, 1921, consists of a suggested general or topical outline for 45 lectures developing the history, importance, relationships, processes, and cultural methods of the principal field crops.

Analyzing a potato enterprise, C. H. SCHOPMEYER (*Fed. Bd. Vocat. Ed. Bul.* 74 (1922), pp. V+39).—The jobs making up a potato-raising enterprise are determined and arranged in eight job groups. Suggestions are made for analyzing and teaching each job, noting its technical knowledge content and related information, giving directions for exercises, and listing reference material. A system of accounting for a potato enterprise is described, and illustrative forms arranged by O. Juve are shown.

MISCELLANEOUS.

Thirty-fourth Annual Report of Maryland Station, 1921, H. J. PATTERSON (*Maryland Sta. Rpt. 1921*, pp. XIX+186, figs. 38).—This contains the organization list; a report by the director on the work and publications of the station; a financial statement for the fiscal year ended June 30, 1921; and reprints of Bulletins 237-243, previously noted. The experimental work reported relating to horticulture is abstracted on page 235 of this issue.

Thirty-fourth Annual Report of Mississippi Station, 1921, J. R. RICKS ET AL. (*Mississippi Sta. Rpt. 1921*, pp. 56).—This, the first annual report to be published since 1910, contains the organization list, a report of the director on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1921, and departmental reports, the experimental work in which is, for the most part, abstracted elsewhere in this issue.

NOTES.

Arizona University and Station.—The board of regents has approved the expenditure of \$17,500 for land and construction of buildings and a pumping plant for the poultry department of the college and station. Work has already begun on the plant.

A tract of 4.5 acres of land adjoining the present Yuma date orchard and horticultural substation has recently been purchased.

An agronomy garden 1 acre in extent has been completed on the university campus. This will be used for both station and instructional work.

The present crop of wheat is the largest in the history of the State, and is almost entirely of the Early Baart variety introduced by the station about 15 years ago. The college is starting a campaign urging the use of bread made from Arizona wheat.

E. B. Stanley, assistant professor of animal husbandry has been given leave of absence for one year, to be spent in graduate work at the Iowa College. Robert H. Burns, assistant professor of animal husbandry and assistant animal husbandman at the New Mexico College and Station, has been appointed assistant professor of animal husbandry, beginning September 1.

California University and Station.—A department of range management has been established with Dr. Arthur W. Sampson, for 15 years plant ecologist of the Forest Service, United States Department of Agriculture and for 11 years in charge of the Great Basin Grazing Experiment Station at Ephraim, Utah, as head of the department. It is planned to carry on range experiments covering the major forage types and climatic conditions of the State, as well as studies to reduce the mortality of live stock from disease, exposure, poisonous plants, and predatory animals, the utilization of range roughage as supplementary feed in winter, and the securing of a higher percentage of off-spring of herds and flocks on the range.

O. L. Lovejoy, formerly in charge of grazing on the Merrimac District of the Plumas National Forest, has been appointed assistant in animal husbandry and given active charge of the range cattle experiment. George C. Kreutzer, superintendent of the Durham State Land Settlement, has been employed by the university on a half-time basis for investigational and advisory work on land settlement. F. A. Carlson has been appointed assistant professor of soil technology at the University Farm, Davis. George H. Wilson, instructor in animal husbandry, G. A. Coleman, instructor in entomology, and D. H. Carey, teacher of olericulture at the University Farm, have resigned.

Rhode Island Station.—Philip H. Wessels, associate chemist, and Myron G. Holmes, assistant chemist, have resigned. Alfred N. Shott and Alfred J. Northam have been appointed assistant chemists.

West Virginia Station.—Harley L. Crane, associate horticulturist, has been granted a year's leave of absence for graduate work at Cornell University. Dr. Leon Leonian has been appointed assistant plant pathologist, beginning September 1.

Association of Land Grant Colleges.—Announcement is made that the thirty-sixth annual convention of this association will be held at Washington, D. C., November 21-23.

EXPERIMENT STATION RECORD.

VOL. 47.

SEPTEMBER, 1922.

No. 4.

Two publications prepared in the Office of Experiment Stations have recently been issued dealing directly with the present status and work of the experiment stations of the United States. One of these is the latest report on the work and expenditures of the stations, covering the fiscal year 1920. The other is the classified list of projects carried on by these stations in 1921. While both these publications are of annual issue and neither is, in any sense, an innovation, they bring together in an epitomized form the latest available information regarding the stations as a whole, and in view of their restricted distribution, as compared with the circulation of the *Record*, comment on some of their more important features may be of interest.

The annual report upon the experiment station system is the twenty-fifth to be prepared. Although a requirement was embodied in the Hatch Act for the rendering of annual reports by the individual stations on their operations and expenditures, several years elapsed before additional legislation directed an examination of their work by the Secretary of Agriculture and a report thereon to Congress. The first systematic visitation of these institutions began in 1895, and together with their financial reports was the basis of the initial report, covering that fiscal year. Subsequently, these reports have been issued without interruption, though with some variations as to form of treatment and subject matter. Taken collectively, they now form a continuous yearly history of the stations for a quarter of a century, and in their pages may be traced the story of many of the problems and difficulties with which they have been confronted, as well as the progress they have made and the results they have secured.

One important feature of these reports has been the presentation of statistics, and the fact that these have been collected and arranged on a substantially uniform plan greatly facilitates comparisons. It may be of interest to note that during the period under discussion, the total annual income of the stations increased from \$1,133,791 to \$7,631,254, and the personnel engaged in the work of administration and inquiry from 584 to 1,968. The number of publications issued during 1897, the first year for which these data were

collected, aggregated 54 annual reports and 324 bulletins, while in 1920 the publications numbered 927. The respective mailing lists totaled 506,101 and 933,933 names.

Closer examination of the stations' revenues indicates a great change in the proportions derived from various sources. In 1896, over 63 per cent came from the Hatch fund, whereas to-day the Federal contributions, although doubled by the Adams Act of 1906, represent less than 20 per cent of the total reported income. Meanwhile, the quota from State governments rose from \$267,663 to \$3,594,441, an increase of over 1,300 per cent. Even more significant is the extent to which these State contributions have become general. Whereas in 1896 half the entire State appropriations were made by New York and Ohio, with no appropriations whatever from 29 States and grants of less than \$2,000 each from 7 others, in 1920 only 6 States reported no direct State support, while 12 States received over \$100,000 each, exclusive of Federal funds. In the latter year both Ohio and Minnesota were appropriating funds substantially equal to the aggregate of the State allotments to all the stations 25 years before.

Such long-range comparisons bring out the great advance which has come in financial support, even though it is still far short of requirements. That the discrepancy in this respect is probably as fully apparent to-day as it was then reflects the unprecedented advance in the vision of the subject and the opportunity for helpful investigation. If the need stood still it would reflect a cessation of growth which would be a sad commentary on agricultural science.

It is scarcely necessary to say that consideration of the total revenues based merely on the comparative figures for the beginning and close of the twenty-five year period would indicate an increased prosperity much greater than has actually occurred, since it would fail to take into account the great change in conditions, notably those brought about by the war. Concerning the actual situation in 1920, the report points out that that year, like those immediately preceding, was really a critical period for the stations, which were attempting to maintain their activities under unusual costs on a pre-war income. As compared with the previous year, "while the total income of the stations showed a small aggregate increase, its purchasing power fell off very materially. In many cases there was no increase in State support, and in a few instances there was an actual decrease. The result was a serious curtailment of the lines of investigation, and inability to take up many questions upon which there is demand for information."

Some indication of the financial difficulties confronting most of these institutions may be afforded by a scrutiny of the funds expended for additions to equipment. In 1896 about \$11,000 was available

for additions to the library, and close to \$15,000 for apparatus. In 1920, despite the great expansion of the station work and personnel and the increased cost of books and apparatus, only about \$21,000 and \$42,000 was disbursed for these respective purposes. In case of the library, the stations have undoubtedly profited by the increased facilities afforded by the colleges with which they are connected, and this has decreased the demands upon their funds for that purpose. The expenditure for scientific equipment, however, is a relatively low aggregate for a group of over 50 scientific institutions, and in the case of numerous individual stations shows an actual reduction from those of the earlier days. To be sure, these items make up only a small proportion of the total budget, but they indicate the scrupulous economy the stations are forced to exercise. The data at hand warrant the observation made in the report that "with decreased purchasing power of the funds available, it has become difficult not only to purchase necessary new apparatus, equipment, and live stock, but in some cases the replacement and prevention of deterioration of the present equipment has become a serious problem."

With respect to the station personnel, while the data further indicate that the number more than tripled from 1896 to 1920, the proportion of the staff giving full-time service to the station actually decreased from 54 to 42 per cent. The 1920 report draws attention to the tendency to utilize more and more the station force for teaching purposes to the frequent disadvantage of the investigational work. That this is not altogether a new difficulty is apparent from the report of 1897, which states that "there is still some difficulty in securing a proper adjustment of the salaries and work of officers employed in both college and station. Teaching involves the regular performance of routine duties, which constitute a drain upon the energies of the teacher that can not easily be measured by the time spent in the classroom. The value of the best performance of either teaching or experimenting can not be estimated in terms of the hours actually spent at the task. The essential thing is that the worker, whether teaching or experimenting, shall have such full command of his time and energies as to secure the best results of which he is capable." Undoubtedly there has been progress in the direction of reducing the amount of teaching by many of the leading workers in the stations, the instruction frequently being confined to advanced subjects or graduate students. Still the interference of other arduous duties is a very frequent cause of complaint, due in many cases to the growth of the colleges; and withal it is not a little surprising to reflect that after all the lapse of years, the tendency as indicated by these figures is in the reverse direction from that generally realized to be desirable.

The change in composition and character of the staff is one that can not escape notice in any comparison of conditions 25 years ago and now. The number of specialists has increased, and their training for research has shown marked improvement. And beyond this the staff is more generally adapted to the special lines of investigation carried on by the station. Originally it was assumed that it must cover the whole range of agricultural subjects—at least be able to supply information over the whole field. It must embrace an agriculturist and a horticulturist, representing the practical aspects of these great divisions, and must have a representative of the chief branches of science related to agriculture—a chemist, a botanist, an entomologist, often a veterinarian, sometimes a geologist, zoologist, and other “consulting” specialists. Specializing came later after the field of agriculture had been seen more clearly and differentiated. The agriculturist passed off the scene, and the agronomist, the soil expert, and the plant breeder marked the splitting up of this subject. Pathologists and physiologists took the place of the general officer assigned to botany, and in horticulture, animal husbandry, dairying, etc., new specialists took up more restricted divisions of the field. Later came geneticists, economists, rural engineers, and others, each marking advance in the conception of the real range and reach of agricultural investigation, and bringing new points of view and new needs for development. For so relatively short a period the change in the organization of the subject of agriculture has been remarkable.

From the historical point of view, it is of interest to note that one of the principal obstacles to the uninterrupted progress of the station work has always been the frequency of changes in the personnel. The earlier reports, however, bear witness to the not infrequent radical reorganizations of the past because of political conditions or other causes which are now comparatively rare. Within late years the changes have still been far too numerous, but the prevailing causes have been the relatively low salaries, the competition of institutions among themselves, and the opportunities open in other lines. The effect of change and instability in the working staff becomes increasingly serious with the broadening technical character of research projects.

In another respect, the station problems of to-day have undergone a radical change. Twenty-five years ago one of their prevailing weaknesses was the dissipation of the meager funds through the attempted maintenance of many substations, resulting in superficial tests in a few localities at the expense of the more fundamental investigations for the general benefit of the agriculture of the entire State. In the interest of conserving the Federal funds, restrictions were found necessary upon expenditures from the Hatch fund for such purposes, although it was pointed out in the report for 1896 that

"if there were abundant means for the purpose there would, of course, be good reason for the establishment of what might be called 'fields of demonstration' at different points in the State, where improved methods of agriculture and simple experiments such as the testing of plants, of field crops, and fruits could be carried on for the instruction of the neighboring farmers." Gradually the provision of State and local funds has brought about the establishment of many substations, cooperative experimental fields, and similar enterprises. The 1920 report notes activities of these types in 37 States, and commenting thereon states that "the plan of extending the experimental work to typical sections of the State has been found advantageous, and in some cases quite essential to a study of local problems. In addition to the broad testing of results secured at the central station, such work brings out the local adaptation which may be necessary."

As regards publications, the statistics indicate increases in both number and distribution which are smaller than might have been expected. For this there are doubtless several reasons. One of these is the higher cost of printing. The report for 1920 points out that the publishing item has now become a heavy one with many stations, amounting in some cases to approximately \$20,000 per annum, while even in the smaller institutions it reaches \$5,000 or more. The need for the husbanding of funds has also tended to decrease the size of the editions, necessitating revision of the mailing lists and limitations in many cases of the number sent outside the State.

Perhaps a more potent factor, however, has been the marked change in the stations' publication policies. Twenty-five years ago a large proportion of the publications were of a popular nature. The stations were the main source of agricultural information for the public, and they sought by all reasonable means to place their bulletins and circulars in the hands of as many farmers as possible. This tended to swell the mailing lists to relatively large figures. Now the lists are more restricted, but they probably represent a more interested constituency. So too, the present-day bulletins are confined for the most part to accounts of the experiments and investigations at the issuing station, and in addition a vast amount of technical material is reported in scientific journals, research series, and through other channels. Likewise, there is now more attention to adapting the publications to the audience. Popular accounts are published in the press, and reliance is rested on the extension service for spreading the results more widely. Hence the total amount of publication has increased to an extent to which there are no data for measuring.

Comparison of the scope and amount of work under way to-day and a quarter of a century ago is hampered by the less formal methods of organizing research in the past. The project method is still

of relatively recent adoption in most of the stations, and only within the last three years has the preparation of a classified list of projects for these institutions as a whole been attempted. The latest of these lists reflects the progress which is gradually being attained in this direction.

According to the revised project list of 1921, the aggregate number of separate projects under way at the stations during that year was 4,770, an average of about 95 per station. Of the total number of projects, 52 are administrative, control, or regulatory, leaving 4,718 projects dealing with experimentation and research. If to these are added 147 projects of the insular stations, the total is 4,865. This is an increase of more than 500 projects over the list prepared for 1920 and of more than 1,000 over the initial compilation of 1919.

The marked increase in the number of projects is somewhat surprising, especially in view of the financial difficulties confronting most of the stations. Probably, however, too great significance should not be attached to a comparison based merely on an enumeration of project titles. Quite certainly one important factor has been the more complete adoption by the stations of the project system itself. Doubtless too, the tendency toward greater definiteness in restating projects has resulted in a splitting up of numerous undertakings formerly described in more general terms, with a consequent increase in the total number but without a corresponding extension of the work actually under way. In still other cases, the addition of new projects without a rigorous weeding out of the list of others in a dormant state would swell the total number.

Making allowance for all such conditions, it is not clear that material progress is being attained toward a concentration of effort, with a stressing of the more important lines of inquiry. Two years ago, when the list showed an average of 65 projects per station, the view was expressed that this number was far too large in the case of many stations and manifestly more than could usually be carried to advantage. From this point of view the 50 per cent increase now indicated would seem to justify close scrutiny by administrative officers of the work under way.

Examination of the list as to classification by subject matter discloses that the increase in number has been particularly marked in agronomy, rising from something over 1,000 projects in 1919 to 1,960 in 1921. This virtual doubling along this line, in itself as large as the entire increase for all projects, is somewhat difficult of explanation but may be caused in large part by the greater itemization in specific groups of studies previously listed under more general headings.

For the remaining subjects, smaller increases are noted. Botany and horticulture now comprise nearly 1,000 projects, and animal

husbandry about 700. There has been an increase from nearly 700 to slightly over 800 projects in plant diseases and insect pests. The stations have averaged to add one more project each in rural engineering and rural economics, but the total number in these lines is still only 159 and 172 respectively. One rather notable development, however, has been the greater attention given to rural sociology. For this subject only two projects were listed in 1919, while in 1921 the number had risen to 30.

One potential service of these lists is the bringing to light of possible instances of duplication of work, fears concerning which are sometimes expressed. As was the case in previous years, the number of instances of duplication, other than that which is necessary to meet the varying requirements of different localities or the rounding out of studies of some of the larger problems, was small. While there is a certain similarity among projects carried by different States, familiarity with the projects shows that they have specific differences and are mainly on an individual basis. Various stations are studying the same general subjects, but the nature and conditions of their inquiries or experiments vary in different instances, so that unnecessary or undesirable duplication is reduced to a minimum.

The compilation of these lists seems to be meeting a well-recognized need. In the words of the 1920 report on work and expenditures, there is already evidence that it "is bringing about a better understanding among the stations in regard to their activities, and that their work is being more specifically outlined. It has tended to remove unnecessary duplication and has gone a long way in the direction of promoting successful cooperation."

Another recent publication is at hand which is of much interest from several points of view. This is a check list of publications of the stations on the subject of plant pathology. It was compiled in the library of the Bureau of Plant Industry, and constitutes one of the series of bibliographical contributions instituted some time ago by the Department Library. Like the list of station projects already referred to, it is issued in mimeographed form and restricted edition.

The check list covers the period from 1876 to 1920, and, according to its preface, aims to include references to all material dealing with plant pathology found in the station literature. The hope is expressed that it will be useful to persons who wish to accumulate or complete files of the literature of the subject, and that it may also have some historical value since it gives opportunity for a general survey of the development of the work on plant pathology in the various stations. In view of the care and painstaking efforts

evidenced in its preparation, it seems certain that both these hopes will be realized.

The material is arranged by stations and series of publications. Altogether nearly 4,000 entries are listed, the Michigan and New York State Stations leading with about 250 entries each. These figures indicate the large amount of attention given by the stations to plant pathology since their establishment. When it is recalled that on the basis of the list of station projects, this subject represents less than 8 per cent of the activities of the stations, the amount of ground they have covered in the field of agriculture as a whole since beginning operations becomes apparent. The need of carefully fostering and systematically developing agencies making readily available the great mass of material which is accumulating is also manifest.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The Kjeldahl nitrogen method and its modifications, A. E. PAUL and E. H. BERRY (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 108-132).—In this report of an extensive investigation of the details of the Kjeldahl nitrogen method, made with a view to perfecting the technique so that discrepancies in results may be avoided, the plan of investigation consisted first in a study of the influence of the various parts of the necessary apparatus, using only pure salts of ammonia for the determinations. This was followed by a study of the details of the digestion, particularly with respect to the influence of the different substances used to hasten oxidation. In this study both ammonium salts and samples of cottonseed meal were used. The method was then studied in detail on the samples of cottonseed meal and on other products, and finally a study was made of the effect on the results of the presence of nitrates in the substances to be digested and of nitrous acid fumes in the atmosphere surrounding the digestion apparatus. Taken in order, the various points brought out in this investigation are as follows:

The Kjeldahl connecting bulb is much more efficient than plain bent tubes with or without bulbs and should be used to obtain the best results. When sufficient acid was used in the receiving flask to neutralize 85.5 per cent of the ammonia distilled over, the amount retained was 99.87 and 99.68 per cent. This is thought to indicate that, while advisable, it is not absolutely necessary to use sufficient acid to neutralize all the ammonia to be distilled over. Practically all the ammonia passes over with the first 75 cc. of the distillate and all of it with 100 cc.

The volume of the liquid in the distilling flask should be kept well above 10 cc. and the flame never allowed to touch the flask above the liquid. To safeguard against this danger the use is recommended of asbestos guards with holes of such a size that only that part of the flask which actually contains the liquid is exposed to the flame.

If mercury is used during the digestion and sulphid is not added to precipitate the mercury before distillation, a loss of from 12 to 15 per cent of ammonia results. When copper sulphate is used in place of mercury the addition of potassium sulphid is unnecessary. Potassium permanganate is of no value and tends to result in a loss of ammonia. It is impossible to get maximum results with sulphuric acid alone. The reagents in addition to sulphuric acid which yield the maximum results in the minimum of time are combined potassium or sodium sulphate, mercuric oxid, and potassium sulphid. If copper sulphate is used in place of mercuric oxid and potassium sulphid the time of digestion must be lengthened.

Detailed directions embodying these findings are given for the nitrogen determination of cottonseed meal. If mercuric oxid is used, the digestion should be continued for 3 hours, and if copper sulphate for 6 hours after the solution clears. The time required for the digestion of other materials with mercury and with copper sulphate, respectively, is given as 1 and 2 hours for

flour, $\frac{1}{2}$ and 2 hours for powdered milk, 2 and 6 hours for gelatin, 1 and 5 hours for egg albumin, and 4 and 8 hours for tankage.

The presence of nitrates in the original sample was found to yield higher results than would be obtained without the nitrate. The addition of nitrates to the digested solution or the presence of nitrous fumes in the hood in which the digestion was being conducted was found to cause a decided loss of nitrogen. The importance is emphasized of eliminating and carefully guarding against the presence of nitrous fumes in the vicinity of the digestion apparatus.

The micro-nitrogen determination in agricultural materials, W. GEILMANN (*Jour. Landw.*, 68 (1920), No. 4, pp. 235-254, figs. 4).—This is a brief discussion of the applicability of the micro-Kjeldahl method to the examination of agricultural materials and of the principal sources of error in the determination and means of avoiding them.

Boric acid for neutralizing ammonia in nitrogen determinations, H. D. SPEARS (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 105-108).—A comparison has been made on 60 laboratory samples of feeding stuffs of the use of sulphuric acid and of boric acid, as recommended by Seales and Harrison (*E. S. R.*, 42, p. 802), in neutralizing the ammonia in nitrogen determinations. Comparable results were obtained with both methods. Bromocresol purple has been found to give good results as an indicator in the determination with boric acid.

A modified method for the determination of phosphoric acid, A. W. CLARK and R. F. KEELER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 103, 104).—A modified procedure for determining phosphoric acid gravimetrically by precipitation with ammonium molybdate solution has been developed at the New York State Experiment Station. The directions for the method are as follows:

"Dissolve 2 gm. of the sample in 30 cc. of concentrated nitric acid and 10 cc. of hydrochloric acid. Boil until solution is complete, cool, dilute to a volume of 200 cc., mix, and pour through a dry filter. Neutralize a portion equivalent to 0.25 gm. with ammonium hydroxid and acidify with nitric acid. Add 50 cc. of 20 per cent ammonium nitrate solution, and then sufficient ammonium molybdate solution to completely precipitate the phosphorus (35 cc. added for samples containing between 6 and 12 per cent of total phosphoric acid). Do not heat the solution, but allow it to stand over night at room temperature. Filter on a weighed porcelain Gooch crucible of 25 cc. capacity dried at 120° C. Wash 8 times with 2 per cent nitric acid, filling the crucible about half full each time. Wash twice with cold distilled water, dry for 2 hours at 120°, and weigh."

The factor for converting the weight of the ammonium phosphomolybdate to phosphoric acid is 0.03723.

The composition and preparation of a neutral solution of ammonium citrate, C. S. ROBINSON (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 92-97).—Previously noted from another source (*E. S. R.*, 43, p. 113).

Sulphur in proteins.—**I. The effect of acid hydrolysis upon cystin**, W. F. HOFFMAN and R. A. GORTNER (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 2, pp. 341-360, fig. 1).—This contribution from the Minnesota Experiment Station is the first of a series of papers reporting an extensive investigation regarding sulphur linkages in the protein molecule, the particular object of the present study being to test the effect on cystin of prolonged heating with hydrochloric acid. Cystin prepared from human hair was subjected to hydrolysis with hydrochloric acid in an apparatus so arranged as to permit the absorption of hydrogen sulphid and carbon dioxide in suitable towers. At stated intervals the process was stopped, an aliquot of the solution removed for analysis, the

CO_2 and H_2S in the respective towers determined, and the process repeated. The analyses of the samples removed at different intervals included determinations of sulphate and total sulphur, cystin by the bromate method, nitrogen not precipitable with phosphotungstic acid, and total amino and ammonia nitrogen.

The data obtained show that there is but little decomposition of the cystin by the method of hydrolysis employed. The ammonia formation, loss of carbon dioxide, and hydrogen sulphid evolution show a very slow progressive decomposition. The phosphotungstate at the end of a long period of boiling is more soluble than at the beginning. The solution at the end of the hydrolysis period is optically inactive. This is thought to indicate that the cystin on long boiling with hydrochloric acid is changed into an isomeric form which is optically inactive and has different physical and chemical properties from the original cystin. It is suggested that this is the form of cystin which has been synthesized, and that the natural *l*-cystin crystallizing in hexagonal plates has never been synthesized.

The determination of the tyrosin content of proteins, O. FÜRTH and W. FLEISCHMANN (*Biochem. Ztschr.*, 127 (1922), No. 1-6, pp. 137-149).—A critical study of various methods of determining the tyrosin content of proteins is reported, with experimental data leading to the conclusion that the most accurate method is the bromin addition method of Brown and Millar, as described by Plimmer and Eaves (*E. S. R.*, 31, p. 807). In this, the protein is hydrolyzed with acid and treated with phosphotungstic acid to free the material from tryptophan and histidin. The gravimetric method is considered to give slightly low, and the colorimetric method of Folin and Denis too high, results. A diazo method, after the removal of histidin by phosphotungstic acid, is thought to offer possibilities for the quantitative determination on further development of the technique.

Edible fats and oils, W. H. SIMMONS and C. A. MITCHELL (*London: Scott, Greenwood & Son*, 1921, 2. ed., rev., pp. VIII+189, figs. 3).—Among the changes in the second edition of this book (*E. S. R.*, 26, p. 258) may be noted an extension of the chapter on margarin and a new chapter on hydrogenated oils.

The unsaponifiable constituents (higher alcohols) of shark and rayfish liver oils, M. TSUJIMOTO and Y. TOYAMA (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze*, 29 (1922), Nos. 4, pp. 27-29; 5, pp. 35-37; 6, pp. 43-45).—The authors report the isolation from the unsaponifiable fraction of shark and rayfish liver oils of two new alcohols, a saturated alcohol of the formula $\text{C}_{20}\text{H}_{42}\text{O}_2$ and an unsaturated volatile alcohol of the formula $\text{C}_{20}\text{H}_{38}\text{O}_2$. The former has been named batyl and the latter selachyl alcohol.

A simpler method of determining acetyl values, L. W. COOK (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 2, pp. 392-394).—The formula suggested, the derivation of which is given in full, is $A = \frac{S'-S}{1-0.00075 S}$

where S and S' = the saponification numbers of the fat before and after acetylation. It is to be noted that this formula, although derived by simple algebraic equations instead of employing the limit of a geometric series as was done by André (*E. S. R.*, 45, p. 716), is essentially the same as that of André, with the exception that the value of the constant is such as to give the acetyl value in terms of milligrams instead of grams.

The detection of soy-bean oil, Urtz (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze*, 29 (1922), No. 4, pp. 29, 30).—The method of testing for soy-bean oil with uranium nitrate or acetate, as suggested by Newhall (*E. S. R.*, 44, p. 805), has been found to be quite unreliable. In the author's experience the characteristic yellow color is produced by pure soy-bean oil either in the

natural state or hydrogenated but not by several commercial samples of soy-bean oil. Linseed oil, crude and refined rape-seed oil, refined cottonseed oil, and peanut oil gave a yellow color but paler than that of soy-bean oil. The author is of the opinion that the color is simply the natural coloring matter of the oil dissolving in the uranium solution and that consequently samples of soy-bean oil which have different natural colors will show the same differences in the color test.

A guide to the detection, separation, and determination of monosaccharids and aldehyde acids, A. W. VAN DER HAAR (*Anleitung zum Nachweis, zur Trennung und Bestimmung der Monosaccharide und Aldehydsäuren*. Berlin: Borntraeger Bros., 1920, pp. XVI+345, figs. 14).—This is an extensive treatise dealing with the identification of monosaccharids, particularly in glucosids, the subject matter including a survey of methods from the literature and descriptions of methods developed by the author for dealing with mixtures containing from two to four monosaccharids. The two concluding chapters give detailed examples of the processes described in the previous chapters as applied to a hypothetical mixture of eight monosaccharids, and to the hydrolysis products of the gum from the apricot tree, chestnut seed saponin, and gum tragacanth.

A study of the details of the crude fiber method, G. L. BIDWELL and L. E. BORST (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 58-70).—A critical study of the Official method of determining crude fiber is reported, together with new details for conducting the determination, which, if followed carefully, is said to yield concordant results. The more important points brought out in the study are summarized as follows:

"Liebig condensers are the most efficient that may be used. Samples taking more than 5 minutes to filter after digestion should not be reported. Samples of high protein content, under delayed filtration, act just opposite to those of low protein content. Any container having 1.5 in. of boiling depth may be used. The presence of fat in charge during fiber determinations noticeably raises the results. There is a gain in ether extract when the charge has been previously digested with 1.25 per cent sulphuric acid. The finer the material is ground the lower the fiber content. More uniform results are obtained using a 40-mesh sieve."

Report on coloring matters in foods, W. E. MATHEWSON (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 196-218, figs. 2).—This report consists principally of tentative methods for the analysis of coal tar food colors, the methods being for the most part adapted from those described by Hess in Bulletin 147 of the Bureau of Chemistry, U. S. D. A. (E. S. R., 26, p. 609).

Effect of the use of different instruments in making a microscopic examination for mold in tomato products, B. J. HOWARD (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 226-229).—A study is reported of the effect upon the mold count of the form of sampling instrument with which the test drop is taken for the Official method of determining mold in tomato products. From the average results obtained by three different observers using various implements for sampling, it was found that the greatest variations occurred with the use of the pipette and the smallest with medium or large scalpels.

Salad dressings and their analysis, H. A. LEPPER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 248-253).—Tentative methods for the analysis of salad dressings are described, and the results obtained in the use of these methods on several types of salad dressing are reported.

Cacao products with special reference to shell content, B. H. SILBERBERG (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 260-262).—A brief description is given of the different stages in the process of manufacture of cacao products,

followed by a discussion of the percentage of shells in the nibs as obtained direct from the hoppers. Samples obtained in 11 out of 17 factories showed an average of 1.32, a maximum of 2.55, and a minimum of 0.65 per cent. It is considered that a fair limit of tolerance in cacao or chocolate products would be 2 per cent on the basis of the original nibs or liquor, or 4 per cent on a fat- and sugar-free basis.

Report on the determination of shells in cacao products, W. C. TABER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 253-259).—The author discusses from the literature and from data obtained at the Bureau of Chemistry, U. S. D. A., the value of various methods of determining shells in cacao products.

The crude fiber method is considered the best single chemical determination, although it does not detect a smaller amount than 4 per cent of shells. A microscopic method of counting the stone cells in a given quantity of the material has been found to give fairly accurate results below a maximum of 5 per cent shells on a fat-free basis. The method is, however, considered to be very trying and tedious, and to require considerable experience in its manipulation.

Report on coffee, H. A. LEPPER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 267-273).—This paper deals with the application of the method of determining caffeine developed by Power and Chestnut (E. S. R., 41, p. 412) to the determination of caffeine in coffee. This method was found to give concordant results and to work equally well on roasted, unroasted, and decaffeinated coffee.

Robusta coffee, A. VIEHOEVER and H. A. LEPPER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 274-288, figs. 2).—The botanical and chemical characteristics of Robusta coffee (*Coffea robusta*), which is being grown on a large scale in Java, are described, and commercial data are given on its economic significance, yield per acre, extent of cultivation, importation, utilization, price, and flavor. The amount of caffeine in Robusta coffee, while appearing to be somewhat larger than in other South American coffee species, does not exceed the maximum limits observed for coffee in general. Aside from the ether extractives, which are lower than in other varieties of coffee, the composition does not seem to differ markedly from other coffees.

A note on the polarization of vinegars, R. W. BALCOM and E. YANOVSKY (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 245-248).—Evidence is presented that the use of lead salts for the clarification of cider vinegar preliminary to polarization may lead to entirely misleading results, particularly if the lead is not removed from the filtrate. It is suggested that preliminary treatment before polarization should be for the sole purpose of removing turbidity and color, and that for this purpose eponit, Norit, or other similar decolorizing carbons would give entirely satisfactory results.

The chemistry of the formation and manufacture of dairy products and factors influencing milk production and the composition and properties of milk, L. S. PALMER (*Minnesota Sta. Rpt. 1921*, pp. 35-38).—This is the progress report on a number of studies on the chemistry of dairy products.

I. *A study of the chemistry and physico-chemistry of churning and the factors which influence churnability.*—By the use of two microscopic methods which have been developed for distinguishing oil-in-water from water-in-oil types of emulsions, it has been found that milk is an emulsion of the former and butter of the latter type. From determinations of the inversion of phases followed by the change in conductivity during churning, it is concluded that the change in type of emulsion is gradual during the churning process, that it is never complete with ordinary cream, and that the inversion of phases is probably complete some time before the butter "breaks." The H-ion concentration of the

cream, particularly with reference to the isoelectric point of casein, is considered to be a factor of great importance in churning, but it is thought the ratio of calcium and sodium ions in the cream is without influence on the rate or extent of inversion of phases in the churning process.

II. *Enzymes of milk and their relation to abnormal fermentations*.—Definite proof has been obtained that the so-called bitter fermentation of milk is the result of lipase action as previously suggested (E. S. R., 43, p. 712). This fermentation proceeds rapidly in sterile samples, particularly at incubation temperature, and is characterized by the liberation of fatty acids, including butyric acid, and by an increase in the viscosity of the milk which makes churning difficult. Heating milk at 72° C. for two or three minutes almost entirely prevents this fermentation.

Other chemical studies on milk and dairy products listed in this report have been previously noted from other sources (E. S. R., 46, p. 802; 47, p. 109).

The cryoscopy of milk, J. HORTVET (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 172-176, fig. 1).—Previously noted from the complete report (E. S. R., 45, p. 500).

Observations on the creaming of milk, O. RAHN (*Kolloid Ztschr.*, 80 (1922), No. 2, pp. 110-114).—Observations are reported on the effect of various factors on the rapidity and extent of the rising of cream in milk under different conditions. The data show that the addition of gelatin leads to a quicker creaming, a thicker layer of cream of a more spongy consistency and lower fat content, and a very complete separation of the fat in the cream. Other colloidal substances hastened and noncolloidal substances retarded the separation of cream from raw milk and restored the creaming power of cooked milk.

Observations of the creaming process through a horizontal microscope revealed striking differences. In raw milk there seemed to be a grouping of fat globules into larger and smaller masses, while in heated milk the fat globules appeared quite distinct. A study of the rapidity of movement of the different-sized globules showed that the larger globules had a much greater buoyancy than the small, and consequently moved up through the liquid more rapidly. It is to this greater buoyancy that the more rapid separation of cream from raw than heated milk is attributed.

Determination of fat in malted milk, J. T. KEISTER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 176, 177).—Points which must be observed in determining fat in malted milk by the Roese-Gottlieb method without the use of ammonia are outlined. It is considered essential to use great care in obtaining a homogeneous emulsion of the sample in water (1-gm. sample in 10 cc. of water). The extraction tube must be shaken at least one minute longer than is required in the case of milk powder or other milk products, and a third extraction is always necessary. In this third extraction a slight amount of insoluble material is sometimes obtained, which must be determined and the proper correction made.

Report on medicinal plants, A. VIEHÖVER (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 2, pp. 155-163).—This annual report on medicinal plants includes the description of a method of detecting molds in drugs, foods, and spices by identifying through staining methods the presence of a specific substance, chitin, and the method of identifying and differentiating plants and plant products by means of the pollen grains.

Tanning materials, A. HARVEY (London: Grosby Lockwood & Son, 1921, pp. VII+182, pls. 6, figs. 29).—This volume, by the author of Practical Leather Chemistry (E. S. R., 43, p. 317), deals with the composition of the more important tanning materials, the manufacture of tanning materials, and the

official methods of analyses of the Society of Leather Trades' Chemists and the American Leather Chemists' Association.

The hypobromite reaction on urea, P. MENAUL (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 87, 88).—This contribution from the Oklahoma Experiment Station consists of determinations of nitrogen in urea by several methods, the results of which are thought to indicate that there is no quantitative liberation of nitrogen when urea is acted upon by hypobromite.

The determination of uric acid in blood, S. R. BENEDICT (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 187–207).—The method described at length in this paper is recommended for application to the Folin-Wu filtrate from human blood (*E. S. R.*, 41, p. 13). The essential difference between the new method and that of Folin and Wu is in the use of an arsenic phosphotungstic acid reagent in place of the phosphotungstic acid reagent of Folin and Denis, and of sodium cyanid instead of carbonate. The arsenic phosphotungstic acid reagent is prepared by dissolving 100 gm. of pure sodium tungstate in about 600 cc. of water and adding 50 gm. of pure arsenic pentoxid, 25 cc. of 85 per cent phosphoric acid, and 20 cc. of concentrated hydrochloric acid. The mixture is boiled for 20 minutes, cooled, and diluted to 1 liter. This reagent is said to yield nearly seven times as much color from a given weight of uric acid as does the phosphoric acid reagent formerly employed.

A colorimetric method for the determination of sugars in normal human urine, O. FOLIN and H. BERGLUND (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 209–211).—The authors have found the colorimetric method of Folin and Wu for the determination of sugar in blood (*E. S. R.*, 42, p. 712) applicable to the determination of sugar in normal urine if the urine is subjected to a preliminary treatment with Lloyd's reagent. To 5 cc. of urine 5 cc. of N/10 sulphuric acid, 10 cc. of water, and 1.5 gm. of Lloyd's reagent are added, and the mixture is shaken gently for two minutes and filtered. Two cc. of the filtrate is used for the sugar determination.

METEOROLOGY.

Climate and forest fires in Montana and northern Idaho, 1909 to 1919, J. A. LARSEN and C. C. DELAVAN (*U. S. Mo. Weather Rev.*, 50 (1922), No. 2, pp. 55–68, pl. 1, figs. 13).—This article presents in some detail data bearing on the relation of weather conditions to distribution and damage of forest fires in this region, and discusses the chances of predicting dangerous weather conditions. The data are presented not only in tables but in a number of charts and diagrams.

It is shown that the fire hazard is much greater in the western sections of the region, particularly in Idaho, than in the eastern, due to the fact that in the western sections there is a high annual and a very low summer rainfall. This results in a luxuriant forest growth with much dead and down material, which "becomes very dry and highly inflammable in summer on account of the low rainfall and the drying, warm winds coming from the desert region east of the Cascades. These winds blow against the sunny slopes and reach their maximum velocity during the hottest part of the day. . . . The record shows five years, 1910, 1914, 1917, 1918, and 1919, with serious forest fires, and the remaining five years, 1911, 1912, 1913, 1915, and 1916, fairly free from fires. The bad fire seasons show subnormal spring and summer rainfall, greater than usual amount of sunshine, somewhat higher air temperatures and wind velocities. . . .

"A comparison of climate and fires by months brings out the fact that it is necessary to have at least 2 in. of rainfall for each month in summer to allay

forest fires. The average rainfall in the Idaho and western Montana sections is lower than this amount. . . . The most dangerous weather for forest fires occurs at the time of a succession of high-pressure areas over the Pacific Northwest. . . .

"The matter of forecasting fire weather in the Pacific Northwest is rendered difficult because there are no fixed points of weather observation to the west of the Pacific coast."

The weather element in railroading, G. H. BURNHAM (*U. S. Mo. Weather Rev.*, 50 (1922), No. 1, pp. 1-7, pl. 1).—The relation of weather, particularly temperature, precipitation, and wind, to trains and tracks and the shipment of perishable products are discussed.

"The weather affects not only the track and rolling stock of the railroad, but also the goods which it transports. This is especially true of the transportation of perishable goods in which temperature is the all-controlling factor." Attention is called particularly to the provision which is made for protection from adverse weather conditions in transit of fresh meats and fish, dairy products, potatoes, citrus fruits, and fresh fruits and vegetables in general.

Köppen's classification of climates: A review, P. E. JAMES (*U. S. Mo. Weather Rev.*, 50 (1922), No. 2, pp. 69-72, pl. 1, fig. 1).—The purpose of this review is to make this classification available in English for detailed use. Köppen's original paper has been previously noted (*E. S. R.*, 42, p. 212), as has also an abstract (*E. S. R.*, 43, p. 418).

Report of the chief of the Weather Bureau, 1921 (*U. S. Dept. Agr., Weather Bur. Rpt. 1921*, pp. 266, pls. 7).—The work of the Weather Bureau during the fiscal year ended June 30, 1921, is reviewed, and the general weather conditions and outstanding meteorological features of 1920 are given, including the usual detailed tabular monthly and annual summaries of climatological data.

It is stated that no material change occurred in the customary annual program of the work of the bureau. Among the features bearing more directly upon agricultural meteorology referred to in the report are warnings of frosts, cold waves, blizzards, and weather conditions damaging to perishable food-stuffs in shipment; the weather forecasts for fire wardens and forestry associations; the highway weather service; special forecasts in connection with orchard spraying activities; harvest weather forecast work; weekly publication of weather and crop data; publication of daily bulletins on rainfall and temperature in the principal corn, wheat, cotton, sugar, and rice growing States; collection of data and issue of warnings of damaging temperatures in the tobacco, fruit, truck, and alfalfa seed districts; and various mathematical studies of the effect of weather on crops, published from time to time as special articles.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 1, pp. 54, pls. 19, figs. 8; 2, pp. 55-115, pls. 20, figs. 20).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for January and February, 1922, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 1.—The Weather Element in Railroading (illus.), by G. H. Burnham (see above); Monthly Mean Temperatures at Arequipa, Peru, by A. J. Henry; Climate and Health in the South American Tropics, by F. L. Hoffman; Death Valley—The Hottest Known Region (illus.), by A. H. Palmer; Weather Records at Lookout Stations in Northern Idaho, by J. A. Larsen; Great Floods in the Ohio 160 Years Ago (illus.), by H. Pennywitt; The Importance of Wireless Weather Reports from Greenland (illus.), by V. Bjerknes; Note on the

Kata-thermometer, by L. Hill; A Corrective Note on Rain Gauges, by S. P. Ferguson; The Aurora of May 14-15, 1921, by H. H. Clayton; The Great Snowstorm of January 27-29, 1922, Over the Atlantic Coast States (illus.), by P. C. Day and S. P. Fergusson; and Unusual Disappearance of Glaze at Topeka, Kans., by S. D. Flora.

No. 2.—Climate and Forest Fires in Montana and Northern Idaho, 1909 to 1919 (illus.), by J. A. Larsen and C. C. Delevan (see p. 315); Dust Spiral Near Flagstaff, Ariz., by F. W. Haasis; Köppen's Classification of Climates: A Review (illus.), by P. E. James (see p. 316); L. F. Richardson on Weather Prediction by Numerical Process, by E. W. Woolard; Meteorology on Captain Amundsen's Present Arctic Expedition, by H. U. Sverdrup; Instruction in Meteorology for Aviators, by W. R. Gregg; The Great Glaze Storm of February 21-23, 1922, in the Upper Lake Region (illus.), by A. J. Henry, J. E. Lockwood, and D. A. Seeley; On the Design of Rain Gauges, by S. P. Fergusson; and Correlation Between Wind Velocities at the Surface and Those in the Free Air (illus.), by L. T. Samuels.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 9 (1922), Nos. 1, pp. [197], pls. 3, fig. 1; 2, pp. [198], pls. 3, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1922, respectively.

Weather, season of 1920, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 11-14*).—Observations at the Northwest Experiment Station near Crookston, Minn., on temperature, precipitation, cloudiness, and frost-free period during 1920 are summarized in tables and compared with the records of the two preceding years, as well as with the 10-year average.

The mean temperature for the year was 39.9° F. The total precipitation was 9.27 in. as compared with a 10-year average of 17.7 in. The frost-free period extended from May 16 to September 30. While the rainfall was unusually low, it was well distributed and the season was one of the most favorable for crops on record.

SOILS—FERTILIZERS.

The nature and properties of soils, T. L. LYON and H. O. BUCKMAN (*New York: Macmillan Co., 1922, pp. V+588, pls. 2, figs. 62*).—This book is one of the Agricultural Science Series, edited by L. H. Bailey. It is a so-called text of edaphology, and attempts to cover the important features of the mechanics, physics, chemistry, and biology of soils.

The first three chapters deal with the general relation between soils and vegetation, soil formation, and geological classification. The next ten chapters deal with the mechanics and physics of soils, taking up such specific matters as the soil particle, organic and colloidal matter, structure and its modification, moisture and its control, heat, air, and absorptive properties. Six chapters are devoted to soil chemistry covering soil solutions, removal of soil nutrients by cropping and leaching, chemical analysis, alkali, acidity, and soil liming.

In dealing with soil biology the authors discuss the carbon, sulphur, and mineral cycles and devote considerable space to the nitrogen cycle. The five final chapters deal with fertilizers, fertilizing practice, and the maintenance of soil fertility.

Composition of the soil and its preparation, J. G. YAMANDI (*Rev. Soc. Rural Córdoba [Argentina], 21 (1922), No. 385, pp. 6007-6026*).—Brief general information is given on the physical, mechanical, and chemical composition of agricultural soils, together with a discussion of the factors in their preparation

and cultivation of importance to the growth of crops, with particular reference to the soils of Argentina.

Soil survey of the Portneuf area, Idaho, H. G. LEWIS and P. P. PETERSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 52, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Idaho Experiment Station, deals with the soils of an area of 743,680 acres, covering the greater part of Bannock County in southeastern Idaho. The area includes several valleys, and is bounded on the west by the Bannock Mountain Range and on the east by the Portneuf Range. The drainage is principally into the Snake River through the Portneuf River. The larger part of the area is dry farmed, but the irrigated area is considerable. The greater part of the land is said to be practically free from alkali.

The upland soils range in color from gray or light brown to dark brown and the bottom soils from brown to black. Including rough mountainous land, rough broken land, rough stony land, scabland, and muck and peat, 23 soil types of 13 series are mapped, of which rough mountainous land and Ritzville silt loam cover 45.2 and 18.2 per cent of the area, respectively.

Soil survey of Fayette County, Iowa, A. H. MEYER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 40, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 463,360 acres in northeastern Iowa, which is composed of almost flat to steeply rolling country. The regional drainage is said to be good.

The soils of the county are derived from glacial drift, loess, and to a small extent from consolidated rock formation. They are grouped broadly as soils developed under excessive moisture and soils developed under optimum humid conditions. Including muck, 23 soil types of 14 series are mapped, of which the Carrington loam, Fayette silt loam, and Clyde silty clay loam cover 42.1, 20.3, and 15.4 per cent of the area, respectively.

Soils of eastern Virginia and their uses for truck crop production, J. A. BONSTEEL (*U. S. Dept. Agr., Bul. 1005 (1922), pp. 70, pls. 23*).—A survey is reported of the general characteristics and crop adaptations of the soils of the Norfolk and Eastern Shore districts of eastern Virginia. The Norfolk district lies south of the James River and Chesapeake Bay, and contains from 50,000 to 60,000 acres of truck crops annually. The Eastern Shore district comprises the greater part of Accomac and Northampton Counties, and contains from 85,000 to 95,000 acres of truck crops annually. The entire region is marked by low relief. There are no great irregularities of surface, very little erosion, and the land is drained chiefly through deep-cut estuaries and small upland streams. Broad undrained areas exist upon the uplands between the more pronounced drainage ways.

The soils of the region are derived from unconsolidated deposits of the Atlantic Coastal Plain, and range in texture from sands and coarse sandy loams to rather heavy loams. Sandy loams and fine sandy loams predominate, and constitute the chief areas used for intensive agricultural occupation. The different soil series follow natural drainage conditions rather closely in their distribution.

Soil and crop maps made of three areas indicate that well-drained sandy loam and fine sandy loam soils are strongly preferred for the growing of truck crops. In the Norfolk district the Norfolk fine sandy loam is the most extensive and the most important truck soil. The Sassafras fine sandy loam is much less extensive, but is considered valuable for truck crop production. The Sassafras and Norfolk coarse sandy loams are of small extent, but are extensively occupied for the growing of both summer and winter truck crops. Loam and gravelly loam soils, and even fine sandy loam soils of the Keyport and

Suffolk series, require artificial drainage to become fitted for truck crop production. Potatoes are said to constitute the leading crop in the Norfolk district. On the Eastern Shore the Sassafras sandy loam is the most extensive and important truck soil. The Keyport sandy loam and Sassafras fine sandy loam are also extensively used. Potatoes also here constitute the most extensively grown crop.

Colorimetric investigation of humus and humification, E. MELIN and S. ODÉN (*Sveriges Geol. Undersökn. Årsbok* 10 (1916), No. 4, pp. 1-46, figs. 5; also in *Internatl. Mitt. Bodenk.*, 9 (1920), No. 5-6, pp. 391-418, figs. 4).—Studies are reported which demonstrated the use of the colorimetric method for studying humus extracts of soils and for determining the degree of humification of organic soils such as peat.

Peat as a carrier for bacteria, G. H. EARP-THOMAS (*Jour. Amer. Peat Soc.*, 15 (1922), No. 2, pp. 18-23).—Brief information is given on the selection and preparation of peat for use in the production of so-called humus fertilizing compounds, the purpose of which is apparently to increase the bacterial population of the soil.

It is stated that the only way to determine the suitability of peat as a bacterial food and carrier is to place the bacteria in the well-prepared natural bed and determine how long they survive. The peat area should be easily and completely drained, and the drains should be so arranged that irrigation can be supplied at will. The most valuable bacteria for humus fertilizing compounds are considered to include the nitrogen-gathering bacteria, both the *Pseudomonas radicola* for legumes and the *Azotobacter* for general crops. The acid bacteria, nitrifying, and sulphur bacteria are also thought to be important.

Increase of the number of *Clostridium pastorianum* Winogradsky in soils partially sterilized with calcium sulphid, G. TRUFFAUT and N. BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 21, pp. 1319-1322).—Continuing work previously noted (*E. S. R.*, 45, p. 422), experiments are reported in which it was found that partial sterilization has a marked influence on the development of *C. pastorianum*. Studies with 15 different soils from Tunis and Morocco showed that of 10 cultures inoculated with different dilutions of the untreated soils 3 fermented, while in the case of partially sterilized soils 8 underwent butyric fermentation within 8 days after treatment. It was further found that the methods of counting used indicated as high as 100,000 *C. pastorianum* per gram of soil, which is from 10 to 100 times greater than the number of *Azotobacter* found by others. It is concluded that *C. pastorianum* is the principal biological agent for nitrogen fixation in soil and not *Azotobacter*.

Green manuring, C. V. PIPER and A. J. PIETERS (*U. S. Dept. Agr., Farmers' Bul.* 1250 (1922), pp. 45, figs. 15).—Practical information on green-manure crops and approved green-manuring practices, based largely on studies conducted at the State agricultural experiment stations, is here presented.

[**Soils and fertilizers**], F. J. ALWAY ET AL. (*Minnesota Sta. Rpt.* 1921, pp. 77-81).—Experimental work in progress at the station on soils and fertilizers is briefly described.

Soil fertility and soil management experiments, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt.* 1920, pp. 26-52, fig. 1).—The results of seven experiments in soil fertility and soil management, employing 242 tenth-acre plats, are reported in some detail and discussed. No final conclusions are drawn.

Fertilizers, O. I. BERGE (*Minnesota Sta. Rpt.* 1921, pp. 107, 108).—Fertilizer experiments on upland soil at the Grand Rapids Substation, in which various applications of manure, peat, and commercial fertilizers have been made to

potatoes, oats, and clover and timothy meadow, have shown that stable manure is apparently the most effective of all fertilizers used. The phosphatic fertilizers have shown the least beneficial effect. The application of peat showed a definite beneficial effect on all crops, but to a much smaller extent than the application of stable manure. Of the commercial fertilizers, potash produced the greatest increase of yields.

The use of fertilizers on dairy farms, A. R. WHITSON and G. RICHARDS (*Wisconsin Sta. Bul. 341 (1922), pp. 24, figs. 4*).—Practical information on the use of fertilizers in the State of Wisconsin is presented in this bulletin.

It is stated that phosphorus and lime are the elements most needed to supplement manure for all crops. The best method of using phosphate on most dairy farms is said to be the regular application of 300 lbs. of 16 per cent acid phosphate or 100 lbs. of 44 per cent treble superphosphate per acre on all grain land being seeded to clover. Potash is considered to be unnecessary except on peat or muck soils.

Vineyard fertilization, C. DUSSERRE (*Ann. Agr. Suisse, 23 (1922), No. 1, pp. 9-12*).—Eight years' experiments on the substitution of chemical fertilizers for stable manure on vineyard soils, conducted in view of the increasing scarcity of stable manure, are reported. The soils were stony, alluvial, heavy red glacial, and alluvial-glacial clay soils.

It was found in all cases that a mixture of one-half manure and one-half chemical fertilizers, furnishing complete fertilization, gave much the best results. On the stony alluvial soil the same results were obtained with manure alone and with chemical fertilizers alone. On the heavy glacial soil the results were in favor of the manure alone, and on the alluvial-glacial clay soil the results favored the chemical fertilizers. It is concluded that a part of the stable manure used as fertilizer for vineyards can be replaced by chemical fertilizers without reducing yields or injuring the quality of the crop.

The fixation of atmospheric nitrogen, J. KNOX (*London: Gurney & Jackson, 1921, 2. ed., pp. VII+124, figs. 7*).—This is the second edition of this book (E. S. R., 31, p. 822). It is stated that while comparatively little work of importance on the theory of nitrogen fixation has taken place since the first edition was published, the development of fixation processes on the technical side has received an enormous impulse, especially under the stress of war conditions. The chief progress has been in the production of synthetic ammonia by the Haber and cyanamid processes and in the methods of oxidizing ammonia to nitric acid.

Contributions to the study of ammonia catalysts, I-V, A. T. LARSON ET AL. (*Chem. and Metall. Engin., 26 (1922), Nos. 11, pp. 493-497, figs. 3; 12, pp. 555-560, figs. 5; 13, pp. 588-593, figs. 5; 14, pp. 647-654, figs. 20; 15, pp. 683-685, figs. 4*).—In the first of a series of contributions from the Fixed Nitrogen Research Laboratory, U. S. D. A., by Larson, W. L. Newton, and W. Hawkins, the general procedure and equipment used in the laboratory for testing ammonia catalysts at atmospheric pressure are described. The second contribution, by Larson and A. P. Brooks, describes apparatus developed and used in the small-scale testing of ammonia catalysts at variable pressures. The third contribution, by R. S. Tour, describes apparatus developed for the moderate scale testing of ammonia catalysts at 100 atmospheres pressure.

In the fourth contribution, by Larson and Tour, experiments on the synthesis of ammonia based upon the results of the previous studies are described, and a discussion of the behavior of a type of iron catalyst under varying conditions of pressure, temperature, and gas velocity is presented. The intimation is made that the decrease in efficiency of ammonia catalysts as the pressure is increased is much greater for some catalysts than for others.

In the fifth and concluding article of the series, by Larson, the experimental results which have been obtained in testing a variety of catalysts are presented to show to what extent results of tests at low pressures are useful in predicting their behavior at higher pressures. It was found that all of 11 catalysts at 1 atmosphere pressure had an efficiency in excess of 80 per cent, while at 100 atmospheres only 4 were able to maintain that efficiency. It was also observed that certain catalysts which had low efficiencies at 1 atmosphere pressure showed the highest efficiencies at 100 atmospheres. These results are taken to indicate that one can not predict from the results on dry gas at 1 atmosphere pressure what the efficiency will be at higher pressures.

The German and American synthetic-ammonia plants, I—V, R. S. TOUR (Chem. and Metall. Engin., 26 (1922), Nos. 6, pp. 245–248; 7, pp. 307–311; 8, pp. 359–362; 9, pp. 411–415; 10, pp. 463–465, figs. 11).—In this series of five articles the methods of construction and operation and types of apparatus and equipment which have been developed in the U. S. Government synthetic-ammonia plant at Sheffield, Ala., and in the German synthetic-ammonia plant at Oppau are described in some detail and general comparisons drawn.

The first article deals with general construction and operation, water and fuel requirements, and facilities for housing of equipment and process. The second article compares the methods of manufacturing hydrogen and nitrogen at the German and American plants, and points out differences in the processes for supplying nitrogen. The construction and operation of carbon monoxid converters are also described. The third article describes the processes and apparatus used at the two plants for the removal of carbon dioxide and carbon monoxid and the additional purification of the gases required for the ammonia synthesis. The fourth article deals with the design and operation of apparatus used for the synthesis of ammonia at the two plants, describing different processes for removing the ammonia, and comparing the costs of construction and production. The fifth and concluding article compares the costs of construction and of ammonia production at the two plants, and considers the synthetic-ammonia problem from the viewpoints of the chemist, engineer, operator, and executive.

Hygroscopicity of some nitrogenous fertilizers, C. H. VAN HARREVELD-LAKO (Arch. Suikerindus. Nederland. Ind. 20 (1921), No. 38, pp. 1254–1263; also Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser., No. 2 (1921), pp. 10).—Studies are reported which led to the conclusion that ammonium sulphate nitrate, sodium nitrate, urea, ammonium chlorid, and ammonium sulphate decrease in hygroscopicity in the order named.

It was found that urea and ammonium chlorid could be stored safely in the driest east monsoon months, although they become damp. This can not be done with ammonium sulphate nitrate. During the damp west monsoon months urea and, to a less extent, ammonium chlorid became liquid. In many localities during the whole year ammonium sulphate nitrate becomes moist on contact with air and in the west monsoon easily becomes liquid. Under these conditions also only a small amount of water is necessary to make a satisfactory solution of ammonium nitrate. Where it is impractical to use sodium nitrate, on account of air dampness, it is thought that urea or ammonium chlorid may be substituted without any special difficulty. The use of ammonium sulphate nitrate in Java is in general discouraged.

Fertilizer experiments with new nitrogenous fertilizers in Brunswick Province, 1920–21, O. NOLTE and A. GEHRING (Deut. Landw. Presse, 49 (1922), No. 5, pp. 31, 32).—Tabular data of the results of comparative tests of 10 different nitrogenous fertilizers with rye on light sandy soil, with potatoes

on light sand and sandy loam soils, with sugar beets on loam soils, with tobacco on light sandy soil, and with meadow lands are presented.

Gypsum ammonium nitrate gave the best results with rye, followed closely by ammonium sulphate nitrate, sodium ammonium nitrate, and potassium ammonium nitrate. Ammonium sulphate gave the best results with potatoes on light sandy soil and ammonium sulphate nitrate on loam soil. Sodium nitrate gave the best results with sugar beets and lime nitrogen and ammonium sulphate with meadow, followed closely by sodium nitrate. Urea gave the best results with tobacco, followed in order by ammonium sulphate nitrate and lime nitrogen.

Comparative experiments with different nitrogenous fertilizers, P. BOLIN (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 217 (1921), pp. 30; also in K. Landtbr. Akad. Handl. och Tidskr., 60 (1921), No. 4, pp. 251-278*).—Experiments on clay, sand, mull, and peat soils, extending from 1916 to 1919, inclusive, to determine the relative fertilizing values of sodium nitrate, ammonium sulphate, and lime nitrogen on nine different crops are reported.

The sodium nitrate gave the best results in all cases, followed by ammonium sulphate in the majority of cases. Ammonium sulphate gave its poorest and best results with potatoes, and its fertilizing value varied from 64 to 94 per cent of that of sodium nitrate. Lime nitrogen gave its best results with turnips, oats, and cabbage. Its fertilizing value varied from 23 to 85 per cent of that of sodium nitrate.

The influence of humus acids on the assimilation of phosphoric acid, K. MACK (*Chem. Ztg., 46 (1922), No. 9, pp. 73-75*).—Studies of the solubility of dicalcium, tricalcium, and ferric and aluminum phosphates in water solutions of so-called humus acids extracted from peat showed that the humus acids are capable of converting the insoluble phosphates into soluble forms, especially in the case of the tricalcium phosphate. Solutions of humus acids were capable of converting insoluble phosphates into more soluble forms in the presence of alkalis, but not to so great an extent as in the absence of alkalis in the case of tricalcium phosphate. On the other hand, the dissolving action of so-called ammonium humate was greater on iron and aluminum phosphates than that of the pure humus acids. Solutions of humus acids in caustic potash and soda had similar action. The alkali carbonates had a stronger dissolving action on phosphates than ammonia.

In order to determine the nature of the action of humus on insoluble phosphates in cultivated soils, studies were conducted with forest soil, composted soil, and garden soil. These soils were extracted with 0.5 per cent ammonia solution. All three soils contained an excess of basic materials, and the phosphoric acid was found mainly in the form of basic phosphates. This is thought to explain the small quantity of phosphates in the extract from the garden soil obtained by treatment with sodium chlorid solution. The extract from the composted soil contained the smallest amounts of iron, alumina, and phosphoric acid in spite of the fact that this soil had the largest phosphoric acid content. This is taken to indicate that excessive liming will injure moor soils, and is thought to disprove the previous assumption that humus acids contain phosphoric acid in organic combination.

It is concluded that aluminum and iron phosphates are fixed by the humus complex in soils in the presence of alkalis or alkaline reacting salts. The productiveness of soils of weakly alkaline character is attributed partially at least to the formation of soluble salts of so-called humato-phosphato-ferric and humato-phosphato-aluminum acids. These acids are thought to serve not only as sources of energy for soil bacteria but also to place phosphoric acid and possibly iron and aluminum in easily assimilable form for plants. The

results of water culture studies with sugar beets are thought to confirm this assumption, in that plants in a nutritive solution containing humus utilized the phosphoric acid much more rapidly than those in a solution of mineral matter only.

It is concluded that phosphoric acid fixed by the humus complex is more available to plants than dibasic phosphates.

Liming in its relation to injurious inorganic compounds in the soils. S. D. CONNER (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 3, pp. 113-124, fig. 1).—Studies conducted at the Indiana Experiment Station on the action of lime in various forms, both calcium and magnesian, in decreasing the injurious action of inorganic compounds in soils on different crops are reported.

The results are taken to indicate that lime may act upon injurious inorganic compounds in soils by neutralizing acidity, by precipitating injurious soluble salts, and by antagonizing excessive soluble salts to a certain extent which can not be precipitated. Much of the harmful acidity of acid soils is attributed to the presence of soluble aluminum salts. Aluminum toxicity was found to be at least partly due to the aluminum ion. This action was more pronounced with barley than with rye. The presence of an abundance of phosphates prevented aluminum injury by precipitation.

Red beets were grown in an acid soil with the addition of monocalcium and tricalcium phosphates, calcium hydroxid, and dicalcium silicate. Popcorn grew with all these materials except calcium hydroxid. The growth of beets and corn was not in proportion to the H-ion concentration or soil acidity.

At pH 3.9, aluminum was more completely precipitated as a phosphate than it was at pH 6 as a hydroxid. Aluminum was much more insoluble as a silicate than at the same acidity as a hydroxid. In field plats lime alone did not produce optimum crops on an acid black sand. Half a ton of acid phosphate or 1 ton of dicalcium silicate per acre produced good crops on limed land. The more active forms of silicates to a certain extent aided in precipitating aluminum salts.

The effect of liming on the composition of the drainage water of soils. T. L. LYON (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 3, pp. 124-130).—In a contribution from the New York Cornell Experiment Station, a review of the literature on the subject is presented. This indicates that applications of calcium oxid and carbonate usually increase nitrification in soils and the removal of nitrogen therefrom in drainage water. Gypsum appears to have a depressing effect on nitrification and nitrogen removal when applied in the comparatively large quantities in which the other forms of lime are usually applied, but there are exceptions to this.

Apparently when conditions are made more favorable for nitrification, they are not always more favorable for sulfofication. In other words, when liming increases nitrification it may or may not promote sulfofication. Excessive applications of calcium oxid may depress the sulfofying process, but this is not true of equivalent applications of carbonates of calcium and magnesium. Magnesium oxid and carbonate are more potent in effecting removal of sulphur than are the same compounds of calcium.

Liming with oxid or carbonate has in many cases increased the removal of calcium in the drainage, and in somewhat fewer instances it has not done so. Clay soils with great absorptive capacity either did not give off calcium when limed or did so to a less degree than did more sandy soils. It seems probable that the magnitude of the absorptive capacity determines the ability of a soil to prevent the liberation of calcium when lime is applied. Magnesium appears always to be liberated when a soil is limed. Gypsum invariably increases re-

removal of calcium and probably of magnesium, although there are less data for the latter substance. Potassium rarely appears in larger quantities when a soil is limed with carbonate or oxid. Gypsum, on the other hand, more frequently effects a liberation of potassium. Little phosphorus has been observed in drainage water.

Need for lime as indicated by relative toxicity of acid soil conditions to different crops, B. L. HARTWELL (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 3, pp. 108-112).—In a contribution from the Rhode Island Experiment Station, it is emphasized that the kind of plant to be grown determines more than any other factor the amount of lime to apply to soil. "The measure of the acidity of the soil by any method which may be adopted is useful, but it must be considered in connection with the crop to be grown before intelligent suggestions for liming can be given. Furthermore, the evidence is against the idea that diverse crops are affected differently by the acidity itself."

A working plan for liming crops on soils of known composition and reaction is briefly suggested. This is based on the range of lime requirements of crops as determined by field tests.

Liming Kansas soils, E. B. WELLS (*Kans. Agr. Col. Ext. Bul.* 32 (1922), pp. 15, figs. 4).—Practical information on the use of different forms of lime on the soils of Kansas is presented in this bulletin.

Lime and American vines, G. DE ANGELIS D'OSSAT (*Atti R. Accad. Naz. Lincei*, 5. ser., *Rend. Cl. Sci. Fis., Mat. e Nat.*, 29 (1920), 11, No. 1-2, pp. 58-62, fig. 1; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 2, pp. 156, 157).—In a further contribution to the subject (E. S. R., 34, p. 221), the author draws the conclusions that chlorosis in vines is due more to the presence than to the quantity of lime in soils, and that its occurrence is eventually governed by free alkalinity of soils and by the lack of emission of certain root acids.

The solution of lime is considered to be governed by the formation and circulation of carbon dioxide in soils, and the production and circulation of carbon dioxide in turn depend upon the physical properties of the soil or upon the form in which the colloids occur in acid or alkaline soils. It is not thought possible to ascertain the details of so complex a matter by a single volumetric analysis of the quantity of lime in a soil.

Fish manure, P. R. SCOTT and W. C. ROBERTSON (*Jour. Dept. Agr. Victoria*, 18 (1920), Nos. 7, pp. 426-429; 8, pp. 493-498, figs. 5).—The purpose of this article is to present information regarding the fish manure industry as a guide for the installation of factories at proper points in Victoria. The plant required is described, and important features of the manufacturing process are illustrated and discussed.

Wool scouring wastes for fertilizer purposes, F. P. VEITCH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, p. 434).—In a contribution from the Bureau of Chemistry, U. S. D. A., a brief summary is given of the present knowledge of the fertilizing value of wastes from wool scouring obtained from experiments conducted on both laboratory and manufacturing scales.

Analyses of a large number of samples of all grades of unscoured wool, both domestic and foreign, are said to show that the water-soluble matter varies from 6 to 33 per cent, averaging 14 per cent, that the nitrogen content other than that of the wool varies from 0.3 to 1.1 per cent, averaging 0.6 per cent, and that the potash varies from 1 to 7 per cent, averaging 4 per cent. Both the potash and nitrogen compounds are said to be water soluble.

Experiments on the mixing of concentrated wool scouring wastes with other waste materials to determine the practicability of handling the material in the

fertilizer factory indicate that there is no difficulty in working the liquors in making base goods.

The concentrated wool scouring waste liquor so far made contains 42 per cent of moisture, 14 per cent of potash, 1.25 per cent of nitrogen, and 14 per cent of grease, while the dried and degreased waste contains 24.5 per cent of potash, 25.5 per cent of nitrogen, and 0.6 per cent of grease. Fertilizer material made from the concentrated waste and other waste material on a factory scale contains 6.5 per cent of water-soluble potash, 6.1 per cent of total nitrogen, 3.4 per cent of water-soluble nitrogen, 1.9 per cent of alkaline permanganate-insoluble nitrogen, and 1 per cent of neutral permanganate-insoluble nitrogen. This material is said to be in excellent mechanical condition and may be handled easily in fertilizer mixing and grinding machinery.

It is estimated that under present conditions the wool scouring plants of this country are wasting annually potash equivalent to approximately 100,000 tons of kainit and 42,000 tons of 4.5 per cent tannage.

The mineral industry, its statistics, technology, and trade during 1920, edited by G. A. ROUSH and A. BUTTS (*New York and London: McGraw-Hill Book Co., Inc., 1921, vol. 29, pp. XV+907, figs. 24*).—This volume reviews the progress during 1920 in the mining and metallurgical industries, and includes sections on asphalt, cement, gypsum, phosphate rock, potash, sulphur, and sulphuric acid.

AGRICULTURAL BOTANY.

Inbreeding and crossbreeding.—The effect of inbreeding and crossbreeding in a wild plant of the sunflower family, J. L. COLLINS (*Jour. Heredity*, 12 (1921), No. 2, pp. 89-93, figs. 4).—The question has arisen whether a cross-fertilized species living wild during its whole past history, and thus subjected only to natural selection, would exhibit inbreeding and crossbreeding results similar to those herein described for maize. While study under controlled conditions of a number of species is considered necessary, a beginning has been made with *Crepis capillaris*, introduced and now growing wild in both North and South America.

In the second generation of inbreeding there was some evidence of reduction in vigor and size, but the next two generations showed plants much smaller and slower in growth than were the noninbred plants. Inbreeding is, then, regarded as causing in this wild plant, which is largely cross-fertilized in nature, marked reduction in the vigor and rate of development. This behavior is comparable to that observed for maize when subjected to inbreeding.

In order to compare further the behavior of the wild plant *Crepis* with that of the domesticated plant maize, the inbred strains of *Crepis* were crossed together and with noninbred strains. The results of these crosses again confirmed the similarity of the behavior of inbred maize and inbred *Crepis*, and indicated a certain similarity of germinal conditions between a species long domesticated and thus subject to artificial selection and a wild species which has never been subjected to such selection.

Reversion in composites.—The sudden appearance of far distant ancestral types of inflorescence, J. L. COLLINS (*Jour. Heredity*, 12 (1921), No. 3, pp. 129-133, figs. 4).—In an F₂ population secured by crossing a plant of a Holland strain of *Crepis capillaris* grown at Berkeley, Calif., for three years with a plant of a strain from Sweden grown in the same garden for two years, a single plant appeared having foliaceous palealike bracts subtending the achenes on the receptacle of every capitulum, whereas the normal condition shows a smooth and naked receptacle. A supposed explanation is offered, with discussion of other possibilities.

Bud variation in Eleagnus, C. S. POMEROY (*Jour. Heredity*, 12 (1921), No. 5, pp. 227-230, figs. 2).—Two variegated forms of *E. pungens* in a city park at Riverside, Calif., have been studied. In both instances branches have been found made up entirely of nonvariegated leaves, showing a reversion to the solid green forms from which the variegated forms are held to have arisen as bud variations.

Round Tip tobacco, a plant "made to order," E. M. ELAST and D. F. JONES (*Jour. Heredity*, 12 (1921), No. 2, pp. 51-56, pl. 1, figs. 5).—A brief account is given of the origin and development of the special wrapper leaf tobacco previously reported by Jones (*E. S. R.*, 45, p. 133) as produced by crossing Sumatra and Broadleaf, and of the qualities of the new type in relation to requirements of consumers.

Heritable characters of maize.—VII, Shrunken endosperm, C. B. HUTCHINSON (*Jour. Heredity*, 12 (1921), No. 2, pp. 76-83, figs. 5).—In continuance of this series (*E. S. R.*, 45, p. 523), the author reports a study of the quality of shrunken endosperm in maize, showing in 1914 an unusual type of indentation in the gram which proved to be hereditary and which is described herein. This was crossed to determine the relation of the responsible factor to other known genetic factors. The earlier and later results are detailed.

Heritable characters of maize.—VII, Male sterile, L. A. EYSTER (*Jour. Heredity*, 12 (1921), No. 3, pp. 138-141, figs. 3).—Failure of maize plants to produce pollen led to observations showing these plants to occur in proportions approximating 25 per cent in progenies from two closely related self-pollinated ears. Crosses and back crosses have shown this male sterility to behave as a simple Mendelian recessive to normal. A description is given of sterile plants as to the differences when compared with the normal, which are apparent only in the tassel and in the anthers.

Heritable characters of maize.—VIII, White sheaths, J. H. KEMPTON (*Jour. Heredity*, 12 (1921), No. 5, pp. 224-226, fig. 1).—White sheath, a maize variation in which usually only the leaf sheaths and husks fail to develop chlorophyll, the character varying not only in the degree of whiteness but also in the location of the first white sheath, has been studied. No reduction in vigor is noticeable in plants of moderate whiteness, though in the most extreme cases yet isolated the character is detrimental to vigorous growth. The character appeared in different degrees in two sister progenies of a Pawnee variety obtained from Lincoln, Nebr. Tabular classification is attempted in order to begin a study of the mode of inheritance of the character.

Anomalies in maize and its relatives, I, P. WEATHERWAX (*Bul. Torrey Bot. Club*, 48 (1921), No. 9, pp. 253-255, figs. 5).—The author records cases of false polyembryony in maize and in *Coix*.

Degeneration in anthers of potato, M. S. G. BREEZE (*Gard. Chron.*, 3, ser., 70 (1921), No. 1822, pp. 274, 275).—In this paper, though dealing in a partial way with the results of investigations started four years earlier, the author attempted to present only a few salient facts relating to degeneracy in potato anthers. In three types of pollen degeneracy noted, prominent features are a large percentage of shriveled grains; hypertrophied grains, many of which contain minute bodies giving the starch reaction to iodine; and entire absence of pollen. The causes of these conditions were not ascertained.

An investigation was started to determine the nature of certain foreign bodies found in the anthers of various economic potato varieties, and a few of the findings are enumerated. These include a bacillus, other small bodies which may be lower organisms, large quantities of starch, minute green bodies (many apparently undergoing fission), and an ascomycetous fungus in stigma, style, and anther cavities.

A curious potato inflorescence (*Gard. Chron.*, 3. ser., 70 (1921), No. 1822, p. 277, fig. 1).—Hot, dry weather is mentioned as a probable cause in connection with numerous plant abnormalities, among these profuse flowering and production of balls in potatoes, and in particular the production in an inflorescence of several small round tubers. Aerial tubers were found also in the axils of the leaves. Some injury is suggested as possibly preventing normal conveyance of elaborated food materials.

Intumescences on the leaves of *Marlea begoniifolia*, M. Y. ORR (*Notes Roy. Bot. Gard. Edinb.*, 12 (1921), No. 60, p. 258).—Temporary subfoliar outgrowths on *M. begoniifolia*, each originating below a stoma, becoming lobed or branched (with related changes in the cellular elements), and finally withering and dying, are described, with suggestion of environmental causation.

Why roots grow downward, H. VAN GUTTENBERG (*Sci. Amer. Mo.*, 3 (1921), No. 4, pp. 311-314, figs. 2).—The statolith theory of plant geotropism, credited, as regards its earlier statements, by the author and also by Darwin (E. S. R., 16, p. 644) to Haberlandt and Nemec, and as herein discussed, is regarded as being still the best explanation of the geotropic behavior of plants.

On the gross structure of an agar gel, C. L. CAREY (*Bul. Torrey Bot. Club*, 48 (1921), No. 6, pp. 173-182, figs. 4).—The exudation, appearing on slight pressure applied to agar gels after they had been swollen in water, of a portion of the contained liquid was studied and was found to be due to a lamellated structure in the gels, probably due to the rapidity of the drying, which varied with the temperature employed. All the gels showed similar structure except most of those dried at room temperature.

The influence of wounding and of oxygen withdrawal on permeability, A. TRONDIE (*Bot. Centbl., Beihefte*, 38 (1921), 2. Abt., No. 3, pp. 353-388).—A study is outlined as carried on with *Allium cepa*, *Pisum sativum*, *Lupinus albus*, and *Vicia faba*, embracing the influence on permeability of keeping shoots in water for different long periods, of keeping roots in water, of wounding in different ways, of reaction course and the occurrence of stimulation, of traumatic excitation during plasmolysis and deplasmolysis, of previous treatment of the shoots in hypotonic solutions, and of oxygen deficiency.

On the differentiation of the leaf tissue fluids of ligneous and herbaceous plants with respect to osmotic concentration and electrical conductivity, J. A. HARRIS, R. A. GORTNER, and J. V. LAWRENCE (*Jour. Gen. Physiol.*, 3 (1921), No. 3, pp. 343-345).—The results of the determinations here considered, made on the north shore of Long Island during the spring and summer of 1914 and 1915, are considered to show clearly that the osmotic concentration is higher while the electrical conductivity is lower in the tissue fluids of ligneous than in those of herbaceous species. Because of the wide geographic range and the great diversity of conditions (xerophytic, mesophytic, and hygrophytic) under which the investigations on osmotic concentration were carried on, there can be no reasonable doubt that the differentiation of ligneous and herbaceous plants with respect to the magnitude of their osmotic concentration is a general biological law. Until confirmed by investigations now in progress in other regions presenting different conditions for plant growth, the results for conductivity can not be asserted to be of universal validity.

The influence of electric light on plant growth, K. TJERBES and J. C. T. UPHOF (*Landw. Jahrb.*, 56 (1921), No. 2, pp. 313-326, figs. 10).—Under electric light seed germinate earlier; bulbs as well as detached twigs develop faster and bloom earlier; beets, beans, flax, and probably other plants produce seed earlier; intercellular spaces become larger, apparently corresponding to increased gas exchange; and chloroplasts are increased in all plants tested. Electric light,

however, hinders the development of phycoerythrin in *Ceramium* and of phaeophyll in *Fucus*, *Ascophyllum* and *Ectocarpus*.

The increase of carbon dioxide in the atmosphere showed only a favorable influence on development in every case where sufficient increase of light was made to condition the corresponding increase of utilization.

Summation of dissimilar stimuli applied to leaflets of sensitive brier (*Schrankia*), L. B. BIBB (*Jour. Gen. Physiol.*, 3 (1921), No. 4, pp. 523-526, figs. 3).—The author has experimented with leaflets of *S. uncinata* in order to determine whether subminimal stimuli of different character, as chemical and mechanical, when applied simultaneously would combine their effects so as to reinforce each other and produce a visible response. The problem was to ascertain whether a subminimal chemical stimulation could be so applied as to lower the threshold of susceptibility to stimulation and cause the leaflets to behave in the forenoon as they normally behave in the afternoon.

A time of day was chosen when the closure of a single proximal leaflet did not provoke closure of the next distal leaflet. An irritating gas was applied to the pinna. A few seconds later a single leaflet was touched; it closed, induced closure of the next distal leaflet, and inaugurated a wave of closure which proceeded until all leaflets on the same side of the midrib were closed. The pinnae of *Schrankia* are thus shown to be favorable for demonstrating the summation of dissimilar stimuli.

The respective rôles of potassium, calcium, and magnesium in cultivated plants, H. LAGATU (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 2, pp. 129-131, fig. 1).—Representation is attempted of the positions of different economic plants in a graphical scheme based on the simultaneous employment of calcium, magnesium, and potassium in fertilizer.

Why flowers fade: The processes of withering, as reduced to botanical terms, H. FITTING (*Sci. Amer. Mo.*, 4 (1921), No. 3, pp. 267-270, figs. 11).—This paper, embodying the results of studies extending over a number of years, details numerous facts applicable practically to the preservation of flowers, and other facts considered as establishing the existence and modifiability in plants of substances comparable to hormones in animal organisms.

Among influences tending to destroy early the chief value of flowers are listed pollinization, traces of illuminating gas, tobacco smoke, exhaustion of the air by breathing, and too strong and sudden heating.

In 1910 the author was able by means of pollinization to arouse new vital activity in the style of *Epidendrum ciliare*. In case of *Phalaenopsis violacea*, such renewal appears to be due to the influence of the pollen tubes which have been meanwhile produced, or else to actual fructification.

Why the plum fails to set fruit, M. J. DORSEY (*Wis. Hort.*, 11 (1921), No. 6, pp. 102-104, figs. 3).—Discussion relates to the various causes and conditions of the three periods of premature fruit cast in plums known as the first, second, and third drop, respectively.

Unusual injury to apples (*Gard. Chron.*, 3. ser., 70 (1921), No. 1822, p. 268).—Superficial blossom-end injury to apples hanging on the tree appears to have been caused by the freezing of the water drops hanging from that portion of the fruit. Bramley Seedling is mentioned as being particularly affected.

Distribution of *Berberis vulgaris* in Pennsylvania, F. D. KERN (*Bul. Torrey Bot. Club*, 48 (1921), No. 10, pp. 263-265).—The attempt is made to indicate and delimit the localities in Pennsylvania where *B. vulgaris* now grows wild. Lists are given of localities mentioned in the literature, of localities recorded on herbarium specimens, of the verification of citations or collections, and of new localities showing *B. vulgaris*. The plant is apparently able to

establish itself under varied natural conditions and is without doubt more widely distributed than is generally supposed.

[**Developmental studies on *Bacterium radicola***], C. BARTHEL (*K. Landtbr. Akad. Handl. och Tidskr.*, 59 (1920), No. 2, pp. 78-89, pl. 1; also *Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 198 (1920), pp. 14, figs. 6).—Studies outlined with data bear chiefly on the developmental conditions of *B. radicola*, following up work previously reported by the present author (*E. S. R.*, 32, p. 433) and by Zipfel (*E. S. R.*, 26, p. 824).

FIELD CROPS.

Experiments in field plat technique for the preliminary determination of comparative yields in the small grains, L. J. STADLER (*Missouri Sta. Research Bul.* 49 (1921), pp. 3-78, figs. 6).—The present paper is concerned with experimental error and field plat technique in preliminary variety and strain tests with small grains.

In variety and strain tests of barley, oats, and wheat, in 5-row blocks, the competing border rows of adjacent sorts gave relative yields often widely different from those of the interior rows of the same plats. Such competitive effects were much more extreme between different varieties than between different commercial strains of the same variety. A considerable error from competition affected tests in rows running north and south as well as rows running east and west. Although the higher yielding varieties were generally favored in competition, the reverse frequently occurred. In some cases a material advantage in yield in the interior rows was converted to a material disadvantage in yield in the border rows.

Competing quality was correlated fairly consistently with yield and with earliness of heading and maturity, but no relation to grain-straw ratio was found in the one season in which this character was determined. A significant correlation between competition and height was found in the wheat variety test of 1921.

Although competition was most closely related to earliness of heading and maturity in the oats tests, it was also related to yield. With wheat, competition was related fairly closely to both yield and earliness, whereas it was not significantly correlated with any of the characteristics studied in barley, though the relation to yield was considerably closer than the relation to any of the other characteristics. In the wheat and oats tests in which earliness and yield were correlated with competition, earliness and yield were correlated quite closely with one another.

Single-row plats, protected from competition by border rows discarded at harvesting, were somewhat more variable in yield than 3-row plats similarly protected, but the difference was not great enough to outweigh their advantage in size. The mean yield of five replicate protected single-row plats is considered more reliable under the conditions of these tests than the mean yield of three replicate protected 3-row plats, which would occupy the same area and require considerably more labor in harvesting and threshing. No consistent difference in variability existed between 3-row and 5-row plats.

Plat variability was increased with enlargement of the experiment field. The number of replications required for a given degree of precision, as measured by the variability of plat yields, is therefore increased somewhat when border rows are added for the control of competition.

The variability of 120 distributed check plats of Kherson oats differed widely from that of 120 distributed plats of Red Rustproof oats adjacent to them. Considering the variability of check yields as a measure of the pre-

cision of the test would result in entirely different conclusions on the basis of the yields of these two check varieties. Adjustment of plat yields on the basis of the yields of check plats resulted in a decrease in plat variability in three tests and in an increase in five tests. In general, the practice was effective on fields of high plat variability and was ineffective on fields of low plat variability. In the oats strain test in which both Kherson and Red Rustproof check plats were included, the Kherson check was more effective than the Red Rustproof check as a basis for adjusting the yields of the Kherson strains, while the Red Rustproof check was more effective as a basis for adjusting the yields of the Red Rustproof strains. The correlation between the yields of adjacent Kherson and Red Rustproof check plats was not statistically significant. Adjustment of the yields of the Kherson check plats on the basis of the yields of the adjacent Red Rustproof plats, and of those of the Red Rustproof plats on the basis of Kherson yields, increased variability.

Experiments with cereals on the Belle Fourche Experiment Farm, Newell, S. Dak., J. H. MARTIN (*U. S. Dept. Agr. Bul. 1039 (1922), pp. 72, figs. 22*).—This report of experiments with cereals on dry land from 1908 to 1919, inclusive, and on irrigated land from 1912 to 1919, inclusive, supplements an earlier account (*E. S. R.*, 34, p. 137). Work with cereals at this substation has also been described from other sources (*E. S. R.*, 42, p. 336; 44, p. 227).

The principal crops on dry land, with the leading varieties and the approved or highest yielding rate of seeding, included spring wheat, Kubanka and Marquis, about 4 pk. per acre; winter wheat, Turkey and Kharkof, 4 pk. per acre on fallow land; oats, Kherson and Sixty Day, 6 pk. per acre; barley, White Smyrna and Hannchen, 4 to 6 pk. per acre; proso, Red Russian, and Turghai, drilled 25 to 30 lbs. per acre; and flax, Damont and Reserve, 2 pk. per acre.

Durum wheats have given higher yields than common spring wheat. Winter wheat averaged higher than spring wheat, but is held rather uncertain on account of winterkilling and soil blowing. The best date for seeding winter wheat seemed to be about September 16. Early-seeded wheat did not survive the winter better than late-seeded wheat. Spring emmer did not equal the best varieties of oats and barley and is not resistant to extreme drought. Winter rye yielded less than winter wheat, but is hardier and more certain. Winter emmer and spelt do not appear hardy enough for successful culture in western South Dakota.

Grain sorghums mature too late and require too much warm weather to be grown successfully at this substation. Manchu Brown kaoliang is the most certain of these crops yet grown there.

The same varieties of spring wheat, winter wheat, and flax were foremost in the trials under irrigation, whereas Silvermine and White Russian oats and Chevalier and Trebi barleys were first in their respective tests. The results of seeding trials suggest rates of 5 pk. per acre for winter wheat, 8 to 10 pk. for oats, and 30 lbs. for flax.

Under irrigation, winter wheat slightly outyielded spring wheat; spring emmer returned less than the best varieties of barley; winter emmer and spelt were not hardy, and small yields resulted; winter rye was not as productive as winter wheat; and buckwheat gave poor returns. Proso was not found to be a successful crop on irrigated land. Mixtures of wheat, oats, and barley did not produce yields of grain significantly higher than the average of the crops grown alone. Mixtures of wheat and flax yielded more than the crops grown alone, but wheat predominated in the mixture.

Grain and corn varieties for northwestern Minnesota, R. R. SMITH (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 86, 87*).—Based on tests at

the Crookston Substation, the characteristics and yields of the principal varieties of spring wheat, oats, barley, and corn are given.

[Report of field crops work in Minnesota, 1920], A. BOSS ET AL. (*Minnesota Sta. Rpt. 1921, pp. 44-47*).—The progress of experiments with field crops at the station in 1920 is described as heretofore (E. S. R., 44, p. 732).

Crosses carried on by H. K. Hayes, F. Griffiee, and C. L. Alexander between White Russian, a side oat resistant to stem rust, and Minota and Victory proved the facility of producing open-panicked varieties resistant to stem rust. Purified crosses of barley, made in an endeavor to produce high-yielding smooth-awned strains excelling in other agronomic qualities, appear to be resistant to *Helminthosporium sativum* and with yielding ability. Corn breeding studies in 1920 by the above and A. N. Wilcox showed a large number of abnormalities to be present in all standard corn varieties with much greater frequency than commonly realized. No progress has been made by the ear-to-row method of selection with Rustler White Dent.

Results of studies of inheritance of seed and spike characters in crosses between Marquis and Preston wheat indicate that length of seed is inherited similarly to other size characters, that the awn of wheat is apparently an important physiological organ; and that awned varieties may be expected to yield somewhat better than awnless wheat. Preliminary studies have shown that resistance in oats to stem rust is a dominant character and is dependent upon a single main factor.

Timothy was found by Hayes and O. I. Bergh to be highly self-sterile under University Farm conditions. Several selections which showed strong rust resistance in the field likewise proved good yielders by the rod-row test. Strains of flax highly resistant under wilt conditions were also obtained.

In studies by A. C. Arny and F. W. McGinnis, the small (secondary) kernels of oats seeded at rates to secure the same number of plants per acre as from large (primary) kernels, sown at the rate of 64 lbs. per acre, gave decidedly lower yields on land of both medium and high productivity; sown at the same number of pounds per acre, small seeds yielded less than either large or ungraded on both soil types. Large and ungraded seed gave equal yields. On highly productive soil, large, ungraded, and small wheat sown at the same rate in pounds per acre and at a rate which gave the same number of plants per acre yielded about equal, and on soil of medium productivity the three grades seeded at the same number of pounds per acre produced equal yields. The small seed gave the lowest yield when sown at the rate giving the same number of plants per acre.

The earlier seedlings of rye and winter wheat gave the higher yields. Rye yielded about the same whether seeded at from 70 to 112 lbs. per acre, and winter wheat seedlings at from 75 to 90 lbs. per acre gave no differences in yield.

Barley and early oats mixed outyielded either crop alone. Medium-maturing exceeded early-maturing oats, and medium-maturing oats and wheat mixed yielded more in pounds per acre than wheat but less than oats.

In tests in different sections of the State by Arny et al., Ruby wheat proved a very medium yielder as compared with Marquis, and Red Bobs was almost a total failure in some localities. Midum spring wheat and Minturki winter wheat were consistently high yielders.

[Report of field crops work at the Crookston, Minn., Substation, 1920], C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 14-26, 58-63, figs. 5*).—The continuation of previous work (E. S. R., 44, p. 330) is reported.

Mindum wheat yielded from 17.8 bu. with a 3-pk. seeding to 29.9 bu. with a 6-pk seeding. Rates of 10 and 13 pk. each produced an average of 52.5 bu. of oats during the period from 1913 to 1920, inclusive. Early seeded barley averaged 28.5 bu., medium seeded 24.7 bu., and late seeded 22.3 bu. per acre. Outstanding in the 1920 varietal trials were Mindum wheat, a Garton oats selection, Victory oats, Akers barley, Minnesota 19 and Minnesota 25 flax, Red Eckendorf mangels, Vilmorin Elite sugar beets, Prizewinner rutabagas, Cowhorn turnips, Mastodon stock carrots, and Minnesota 13 corn.

In rotations from 1912 to 1920, inclusive, the following average acre yields were produced: Wheat in 3-, 5-, and 7-year rotations, 21.7, 21.3, and 20.4 bu., respectively; wheat continuously, 16.1 bu.; wheat continuously with 6 lbs. of clover, 14.3 bu.; oats in 5-year rotation, 47.1 bu.; oats in 7-year rotation, 55.5 bu.; barley in 7-year rotation, 33.8 bu.; and flax in 7-year rotation, 14.1 bu.

Irish Cobbler led the early potatoes with 123 bu. per acre, and Green Mountain the late varieties with 112.3 bu. Where standard Bordeaux mixture was applied July 1 and at 10- to 14-day intervals thereafter, plats receiving one application produced 75 bu.; two, 82.5 bu.; three, 97.5 bu.; four, 95 bu.; and five applications, 112 bu., as compared with 70 bu. on an unsprayed plat. The potatoes on the sprayed plats survived drought much better than those on the unsprayed. Plats treated with corrosive sublimate and formalin gave 82 and 75 bu., respectively, of marketable potatoes and the untreated 70 bu. The tubers from corrosive sublimate plats were uniformly clean and bright, while those from the check were badly specked with scab and scurf. Formalin had very little, if any, effect on black scurf.

Net acre yields of tubers in a size-of-seed test were single eye (1 oz.) 46.5 bu., double eye (1 oz.) 55.3 bu., quarters (1 oz.) 81.7 bu., halves (2 oz.) 86.4 bu., small whole (1.9 oz.) 67.6 bu., small whole (2.4 oz.) 79.3 bu., medium whole (4 oz.) 108.7 bu., and large whole (9 oz.) 78.1 bu. Where from 10 to 20 bu. of cut seed per acre 16.5 to 83 in. apart in the row were used, the net yields ranged from 89 to 106 bu., the maximum yields being obtained from the largest quantity of seed dropped from 8 to 9 in. apart in the row. In normal years this space has been hardly sufficient for top growth.

The 3- and 4-year rotations gave the highest yields of potatoes, while the cleanest stock was produced on the 5- and 7-year rotation fields. Observations indicate that the soil can not be put in the physical condition required for potatoes as easily in the long as in the shorter rotations. The seed-selection tests demonstrated that a more uniform product can be obtained from seed selected for type than from field-run or run-out seed.

[Report of field crops work at the Grand Rapids, Minn., Substation, 1920]. O. I. BERGH (*Minnesota Sta. Rpt. 1921, pp. 106, 107*).—The progress is reported of work along lines similar to those noted previously (*E. S. R.*, 43, p. 822). Leading varieties of cereals included Prelude and Preston five wheats, Mindum durum, Minturki winter wheat, emmer, Norway oats, Manchuria barley, and Rosen rye. The best time for planting winter grains appeared to be from August 15 to September 1 for wheat and from August 15 to September 15 for rye.

Strains of potatoes from other States and from different sections of Minnesota were tested in cooperation with the U. S. Department of Agriculture. Green Mountain strains yielded from 171.7 to 289.9 bu. per acre, Rural New Yorker from 191.9 to 215 bu., Early Ohio from 205.4 to 278 bu., Irish Cobbler from 243.7 to 264 bu., and Bliss Triumph from 102.1 to 248.8 bu. When the varieties named and Burbank Russet were planted in rows 3 ft. apart with hills 20 in. apart the increased yield of the two plants adjoining a missing hill made up

12 per cent of the loss. The varieties showed no significant difference in their ability to utilize the greater available space.

[**Report of field crops work at Waseca, Minn., Substation, 1920**], R. E. HONGSON (*Minnesota Sta. Rpt. 1921, pp. 116, 117*).—The experiments reported comprised varietal trials and breeding work with cereals and fertilizer tests with various field crops. The following varieties excelled: Silver King corn, Minturki winter wheat, Marquis spring wheat, Mindum durum, Minota oats, French Chevallier barley, Rosen rye, and Elton soy beans.

Dry farm crop production in eastern New Mexico, J. S. COLE (*New Mexico Sta. Bul. 130 (1922), pp. 32, figs. 5*).—The present publication adds to the information in Bulletin 104 (E. S. R., 37, p. 328), and includes experimental data secured at the Tucumcari field station to and including 1920, and precipitation and frost data including 1921. In interpreting the results similar experiments, conducted at the Dalhart, Amarillo, and Big Spring, Tex., stations, were also considered.

Eastern New Mexico has an average annual rainfall of from 15 to 20 in. and a frost-free season of from 175 to 200 days. The dry winter and spring are very unfavorable to the growth of either fall or spring seeded small grains. The heaviest precipitation takes place from May to August, making conditions favorable for late-season hot weather crops, such as the sorghums.

Dwarf and early varieties of milo and kafir are considered better adapted than the larger standard varieties. For grain production kafir and milo are about equal, but kafir makes better yields and better forage. Honey and Sumac, sweet sorghum varieties, are said to be the heaviest and surest producers of forage. Broom corn is a reliable cash crop, the dwarf standard type producing about 500 lbs of brush per acre. Other adapted crops are corn, cowpeas, beans, and millet. Planting should be deferred until conditions are favorable for germination and growth without soil blowing. The best average planting period is the last of May and the first half of June.

Cultural methods are governed by the necessity of preventing soil blowing. Fall plowing has a small advantage in average yield over spring plowing, but is more liable to blowing. Planting with a lister without previous cultivation proved distinctly inferior to plowing and surface planting. Fall and winter cultivation before listing, or listing in fall or winter and then cultivating to prevent blowing or weed growth until planting time, are regarded as good preparations. Planting should be in furrows and not by splitting the ridges. Fallow has been found difficult to keep from blowing, and does not increase yields over safer methods enough to warrant its general use. Green manure has not increased yields over those after a harvested crop.

A study of the grasses of Arizona, J. J. THORNBUR (*Abstr. in Science, n. ser., 55 (1922), No. 1429, p. 546*).—This paper, presented at the southwestern division of the American Association for the Advancement of Science at Tucson, Ariz., in January, 1922, includes a study of the 260 species of grasses of Arizona, with comparisons of the grass floras of New Mexico and Colorado. The grasses of northern and southern Arizona were compared in numbers, species, and the origin of species, typical species of these two grass floras being noted.

The grass flora of Arizona consists of 55 per cent of southern and southwestern species, 25 per cent of northern species, and 20 per cent of introduced species. The largest genera of grasses in Arizona in order of number of species are as follows: Muhlenbergia 23, Panicum 19, Bromus 19, Bouteloua 14, Sporobolus 12, and Aristida 10.

Important cultivated grasses, C. V. PIPER (*U. S. Dept. Agr. Farmers' Bul. 1254 (1922), pp. 38, figs. 26*).—Agronomic and botanical information and illus-

trations are given to enable farmers and others to become familiar with the most important and most common grasses of the United States.

Root crops for northern Minnesota. T. M. McCALL (*Minnesota Sta. Crookston Substa. Rpt. 1920, pp. 89-96, figs. 2*).—Cultural directions and varieties are recommended for the production of mangels, rutabagas, turnips, stock carrots, and sugar beets, based on results of experiments at the Crookston Substation. Feeding analyses of the first four crops are tabulated.

Waxy endosperm in Coix and sorghum. J. H. KEMPTON (*Jour. Heredity, 12 (1921), No. 9, pp. 396-400, fig. 1*).—A waxy type of endosperm found in several varieties of Coix and also in one sorghum variety is entirely similar in appearance to the waxy endosperm of maize, and presents the same sharp contrast with the horny endosperm as well as with the loose or floury portion of the kernels. It may be expected that in Coix as in maize the waxy endosperm will behave as a definitely alternative character recessive to the horny form. "From the standpoint of the origin of waxy endosperm in maize it seems suggestive that waxy endosperm in Coix is found in the same isolated regions in eastern Asia, and as with maize (E. S. R., 44, p. 230) Burma seems to be the most important center."

An unusual type of proliferation in *Agropyron cristatum*. C. V. PIPER (*Jour. Heredity, 12 (1921), No. 9, p. 423, figs. 4*).—In a case of proliferation in *A. cristatum* occurring at Redfield, S. Dak., in 1920, 4 of the spikelets were replaced by elongated leafy branches considerably longer than usual. In about 12 other spikelets the axis above the glumes was elongated, and one or more of the lower lemmas appeared as somewhat elongated bracts, the remainder of the spikelet being normal. In all of these modified spikelets the two (empty) glumes remained unchanged.

Production of new strains of corn for New York. C. H. MYERS, H. H. LOVE, and F. P. BUSSELL (*New York Cornell Sta. Bul. 408 (1922), pp. 209-268, figs. 11*).—Corn breeding investigations involving the ear-to-row method are described, with notes on the three strains of Yellow Dent produced. The selection coefficient employed, obtained by multiplying the average yield per stalk by the percentage of maturity, did not appear of greater advantage than one obtained by multiplying the total yield per row by the percentage of maturity. Mass selection was practiced to maintain the strains produced by individual selection.

Cornell 11 was derived from Pride of the North in Cayuga County and is said to give a good yield of grain and medium yield of stover. Webber Early Dent was derived from Funk Ninety Day in Saratoga County, and its yield of grain and stover is similar to that of Cornell 11. Cornell 12, produced in Westchester County, was also derived from Funk Ninety Day, and, while not markedly different in type from Webber Early Dent, it matures from 10 days to 2 weeks later and gives heavier yields of grain and stover than either of the other strains.

From a consideration of the data presented, attempting selection for high yield or earliness by choosing ears that exhibit certain characteristics does not seem practicable. The average circumference of the seed ear is the only factor that showed any consistent relation to yield. Selecting good, sound ears from early and high-yielding progenies is evidently more satisfactory.

The outcome of three years' cooperative experiments comparing early, medium, and late maturing varieties for silage and grain purposes indicates that the early dents, though slightly lower in yields of dry matter, are to be preferred for silage purposes because of their greater digestibility, higher yield of grain, and greater economy of handling.

The use of the greenhouse in corn breeding, F. D. RICHIEY (*Jour. Heredity*, 12 (1921), No. 9, pp. 393-396, figs. 2).—Although the greenhouse does not seem very useful in the earlier years of selection from a commercial corn variety, the percentage of culls being so large as to require field conditions for adequate material, many of the later phases of corn breeding appear adapted to greenhouse manipulation. The height of the corn plant, its need for abundant room, and the necessity for maintaining relatively high temperatures require facilities planned specially for the crop, such as a house without side benches and with as low a solid wall as possible.

Studies in Gujarat cotton, I, M. L. PATEL (*India Dept. Agr. Mem., Bot. Ser.*, 11 (1921), No. 4, pp. 75-127, pls. 8, figs. 7).—A general review of cotton production in Gujarat is given with details of the history, characteristics, hereditary characters, extent of admixture and hybridization, and pure line strains of Goghari cotton. Strains of this variety are compared with purebred Broach deshi cotton.

Wisconsin oats, B. D. LEITH and E. J. DELVICHE (*Wisconsin Sta. Bul.* 340 (1922), pp. 30, figs. 8).—Cultural methods, field practices, and varieties considered suitable for the production of oats in Wisconsin are recommended on the basis of experiments at the station and substations. The results of extensive varietal trials are tabulated.

Oats is the most important cereal crop in the State, the acreage amounting to about 1.25 times that of corn, 4 times that of barley, and 5 times that of either wheat or rye. Five pedigree varieties of outstanding merit have been developed by the station to meet particular conditions, and include Swedish Select, Pedigree No. 5, for soil not too heavily charged with nitrogen and organic matter; Wisconsin Wonder, Pedigree No. 1, for rich soils; State's Pride, Pedigree No. 7, a pure line selection from Kherson, for very rich soils; White Cross, Pedigree No. 19, a pure line selection from Big 4×Sixty Day; and Forward, Pedigree No. 1241, a selection from Silvermine.

Percentage of hull varied with the variety and season, and seasons did not affect all varieties alike. As low as 24 per cent and as high as 52 per cent of hull have been found in oats at the station. During six years drilled oats averaged 59.9 bu. and broadcasted oats 61.5 bu. per acre, indicating that type of seeder is of small consequence, provided the grain is placed where it will receive sufficient moisture and is properly covered. Tests at Marshfield indicate strongly that heavy rates of seeding will cause lodging. Equal amounts by weight of Marquis wheat and Wisconsin Wonder oats were planted together at the rate of 2 bu. per acre, and the mixture produced 1,881 lbs. of grain compared with 1,701 lbs. with oats alone and 1,182 lbs. with wheat alone. In both years the oats in the mixture was of better quality than that in the other plats, and no lodging occurred. In neither year was the wheat attacked by rust, although an adjoining strip of Marquis was badly rusted in 1920.

The influence of the weight of seed on the yield of oats, TORNAU (*Jour. Landw.* 69 (1921), No. 4, pp. 205-213).—The primary and secondary kernels of 3 two-kerneled pure lines of oats and the primary, secondary, and tertiary kernels of 2 three-kerneled lines were planted in pots.

While the final yields were practically equal whether large or small kernels were used, the larger showed their superiority by earlier development. The effect of hereditary qualities was shown clearly, for while the large grain exhibited good early growth, this was not apparent in yield differences. Differences between the individual lines were insignificant.

The course of growth of potato tubers, D. T. MacDOUGAL (*Abs. in Science, n. ser.*, 55 (1922), No. 1429, p. 546).—The growth of potato tubers was measured at Carmel, Calif., by means of the auxograph. During the development period of 60 to 80 days, the highest rate of enlargement of diameter of the tuber was in its earliest stages, when less than 1 cm. in diameter. The highest rate of increase in volume ensued much later, when the tuber had reached about three-fourths of its final size.

Seed potato improvement, G. R. Hyslop (*Oregon Sta. Circ.* 25 (1922), pp. 8, fig. 1).—The need for improvement of seed potatoes in Oregon is indicated, the reasons for small yields are pointed out, and remedies are proposed.

Small yields are ascribed to too many varieties, unproductive hills, poor stands, and not enough plant food or moisture. In order that more Oregon farmers may secure better yield and quality and achieve certification, the station suggests using only smooth, symmetrical, medium sized tubers for seed, clipping off the stem end of the potato and examining for stem end discoloration, treating all seed in a corrosive sublimate solution, cutting the potatoes to save the blossom end piece, coating cut seed with land plaster, planting the potatoes on clean land, planting to get a stand, keeping fields clean of weeds, roguing out all weak, sick, or diseased plants, and harvesting and storing carefully.

Potato investigations, F. A. KRANTZ (*Minnesota Sta. Rpt.* 1921, p. 66).—No difference was found in the yield or form of tubers between lots of Early Ohio potatoes obtained from growers who had practiced continuous selection in the same seed stock for 20 years or more and those from growers practicing little or no selection. A study of the form, formation of knobs, prominence of eyebrows, prominence of lenticels, and color of tubers disclosed that all lots were similar in these characters, and that Early Ohio gave no indication of running into definite strains. The degeneracy occurring in potatoes at University Farm was found due to a transmissible disease very similar to mosaic and probably a severe expression of it. Experiments indicate that the disease is not transmitted through the soil and does not harbor over in the soil from one season to the next. Healthy potato plants, protected by insect cages in badly infected fields, gave indications that sucking insects appearing on the plants after July 5 are the only means whereby the disease is spread.

Potatoes as a crop for northern Minnesota, T. M. McCall (*Minnesota Sta., Crookston Substa. Rpt.* 1920, pp. 96-106, 110, 111, 113, 114, figs. 3).—Practical information regarding the growth of potatoes in northern Minnesota is given, with a summary of experimental results with the crop at the Crookston Substation. Conclusions based on the investigations may be summarized as follows:

Early Ohio and Irish Cobbler are recommended for the heavy soils and Irish Cobbler and Green Mountain for the lighter soils. Quartered or halved seed pieces, weighing from 1 to 2 oz., produce the most profitable yields. Maximum yields can be expected with the use of from 16 to 18 bu. of cut seed per acre.

Only slight increases may be looked for from the use of complete fertilizers on heavy soils not noticeably depleted. Short rotations including clover and one application of manure are conducive to high yields of potatoes. Acid phosphate alone produces greater yields than with manure. With good cultural practices in a 4-year rotation, fair yields may be maintained on the heavy soils without manure, legumes, or fertilizer. Eight tons of manure in two applications in a 4-year rotation gave higher yields than lesser or greater amounts in one application. One ton of straw plowed under increased the yields 15 bu. per acre, greater amounts appeared detrimental, and 2 tons of burnt straw per acre

decreased the yields. Bin selection and hill- and tuber-unit selection have proved valuable means of increasing yields.

Field tests with sugar beet, A. E. V. RICHARDSON (*Jour. Dept. Agr. Victoria*, 18 (1920), No. 10, pp. 587-592).—Cultural, varietal, and fertilizer trials with sugar beets were made at Boisdale, Victoria, on a fertile black clay loam, producing average yields of 15 tons per acre.

Beets sown early, late in August and the first half of September, gave about 5 tons increase over those seeded later. The acre yields were heaviest with a 16-in. spacing, and progressively diminished as the width of rows increased to 24 in. However, 18 in. was most profitable, saving labor without a material diminution of yield. The crop was a comparative failure without tillage, but yields increased with each cultivation up to a maximum of four when the liability of damaging the roots and tops and depressing the yield precluded further tilling. The influence of rate of seeding on yields was not marked, little variation being noted between the seedings of 10 and 14 lbs. per acre and no benefit obtained by increasing the quantity beyond 14 lbs.

On the soil employed phosphatic fertilizers applied at rates of 2 cwt. or more per acre, stable manure, and nitrogenous manures were profitable, whereas lime and potash appeared to be without effect. About four weeks after germination appeared to be the best time to thin beets. Acclimated seed gave better yields than freshly imported seed.

Use of wooden constructed fire heated hotbeds for production of sweet potato plants, C. L. ISBELL and W. D. KIMBROUGH (*Alabama College Sta. Bul.* 217 (1922), pp. 6, figs. 3).—Descriptions are given of the methods employed in the construction of two fire heated sweet potato beds, one 40 ft. 10 in. by 7 ft. and the other 41 ft. 6 in. by 11 ft. 3 in. Records taken during the plant-growing season showed that not only were more plants grown per unit area in the wider bed but also less time and fuel were required in their production. Suggestions for the management of similar beds are included.

Milling quality of Saskatchewan wheat, M. CHAMPLIN and C. H. GOULDEN (*Sci. Agr.*, 2 (1922), No. 9, pp. 283-305, figs. 10).—Milling and baking trials with the leaders in wheat variety tests at the University of Saskatchewan during the period 1913 to 1920, inclusive, are reported in tabular form, and the qualities of the several varieties are discussed in groups. The group with the highest milling quality includes Marquis, Red Fife, Kitchener, and Red Bobs, and the second group, with fair milling value but not equal to the first, comprises White Bobs, White Fife, and Taylor Wonder.

Tests of Marquis wheat, cut in the milk, early dough, and late dough stages, and when the kernels were hard and glazed, gave evidence that loaf volume and the percentage of gluten increase directly with the maturity of the grain, while weight of loaf and water absorption decrease slightly. Flour color improves noticeably with maturity, the early cuttings being a little grayish in tinge. It is deemed very important to allow the wheat to reach at least the dough stage, preferably the late dough stage, before cutting. Trials with Marquis led to conclusions that time of seeding apparently has very little influence on the quality of the wheat grain produced, provided the crop is early enough to escape rust and frost damage.

Milling and baking tests with strains under trial are considered of great value, giving an accurate indication of any improvement made in quality, and enabling the breeder, with a considerable degree of certainty, to eliminate the poor quality strains, and thus saving labor and expense.

HORTICULTURE.

[Report of the] division of horticulture, W. H. ALDERMAN ET AL. (*Minnesota Sta. Rpt. 1921, pp. 63-66, 67*).—In continuation of the usual annual reports (E. S. R., 44, p. 739), the activities under various horticultural projects are briefly reviewed, without the inclusion of data.

Selection of promising wild blueberry plants by W. G. Brierley and the author was continued in northern Minnesota during the summer of 1920. Of those plants selected in 1919, 85 per cent survived transplanting. However, a considerable number were lost during the succeeding winter by heaving of the soil. Injury of this nature was much less on that half of the bed which had been mulched with 1 in. of peat.

A comparison by Brierley and the author of shoot growth and manner of wound healing on 1,500 apple trees included in fall v. spring pruning experiments in orchards at University Farm, Newport, Rockford, and Willmar, indicated no difference in favor of either season.

In studies by W. T. Tapley and J. W. Bushnell, the inbred strains of Hubbard squash developed by the station proved satisfactory when compared with first generation hybrids and with commercial stocks.

[Horticultural activities at the Crookston, Minn., Substation], C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 52-58, 64-70, 75-86, figs. 4*).—Miscellaneous data obtained in variety tests of vegetables, fruits, and ornamental trees and plants are reported.

Varietal testing of vegetables was continued in 1920 (E. S. R., 44, p. 336), with data on yields presented in tabular form. Observations on hardiness of various species and varieties of fruits indicated that Patten (greening and Hiberna) apples suffered severe winter injury in their young twigs. Virginia, Transcendent, Arctic, and Early Strawberry crabs bore some fruit in 1920. Virginia crab trees growing in sweet clover sod continued to make a superior growth.

Of grapes tested in 1920, Beta and Campbell Early bore satisfactory crops. All varieties of raspberries, including Cuthbert, King, Sunbeam, and Turner were killed back in the winter of 1920-21. Houghton and Carrie goosberries and Perfection, Red Cross, and Long Bunch Holland currants fruited during the year. Strawberry seedlings No. 389, 589, and 835, obtained from the fruit breeding farm at Zumbra Heights, Minn., are deemed of equal value to the variety Senator Dunlap. Lists of fruits and of trees, shrubs, and vines suitable for northern Minnesota are included.

A paper by T. M. McCall summarizing work in varietal testing of vegetables carried on at the substation since 1918 is appended.

Report of committee on fruit breeding farm, C. WEDGE and A. W. LATHAM (*Minnesota Sta. Rpt. 1921, pp. 68-72*).—This paper is devoted largely to descriptive data on promising new fruits (apples, plums, cherry hybrids, and small fruits) growing on the grounds. Of these, the Zumbra cherry is deemed to be of particular value to northern fruit-growing sections. Successful crosses between the Persian walnut (*Juglans regia*) and the native walnut are recorded.

[Report of the] fruit breeding farm, Zumbra Heights, C. HARALSON (*Minnesota Sta. Rpt. 1921, pp. 67, 68*).—The following seedling fruits developed or tested at the farm were named during the year: Wedge and Folwell apples; Winona, Mound, and Anoka plums; Nokomis, Easy-picker, and Chaska June-fruited and Deephaven ever-bearing strawberries; and Como gooseberry.

Graftage: Theory and application, L. DANIEL (*Min. Instr. Pub. [France]*, *Bul. Off. Dir. Recherches Sci. et Indus. et Invent.*, 1921, Nos. 20, pp. 354-371, figs. 15; 21, pp. 385-409, figs. 26; 22, pp. 449-478, figs. 23; 23, pp. 518-535, figs. 17; 24, pp. 577-590, figs. 12; 25, pp. 664-680, figs. 7).—This is a general review of the author's work with many different genera and species of plants, with special reference to the obtaining of graft hybrids.

Recent progress in the development of improved strains of greenhouse tomatoes, lettuce, and cauliflower, J. H. BEATTIE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 26-28).—A brief account of the activities of the U. S. Department of Agriculture in the improvement of glasshouse vegetables.

Selective studies with Erfurt Dwarf Forcing cauliflower begun about 1908 have resulted in the isolation of three desirable strains, one of extremely rapid heading character and two valuable market types. Two desirable strains of Grand Rapids lettuce, one a finely curled, upright growing plant of slightly yellow tinge and the other coarse leaved, upright growing and of dark green color, were obtained. Two English forcing tomatoes, Stirling Castle and Sunrise, have also been improved by selection in respect to vigor, freedom from disease, and uniformity.

Results of selection in the Alaska pea, J. W. BUSHNEIL (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 41-47).—Observations on the comparative performance of selected pure line strains and of five commercial stocks of Alaska peas at the Minnesota Experiment Station indicated that not only did some of the selected strains outyield the commercial stocks, but also that the strains differed sharply between themselves in respect to yields of pods, as indicated by a range in yield from a minimum of 6.2 ± 0.27 to a maximum of 10.5 ± 0.44 .

Progress in methods of practical fruit growing, R. G. HATTON (*Jour. Roy. Agr. Soc. England*, 82 (1921), pp. 49-117, figs. 7).—In this comprehensive résumé of improved practices in the growing of various tree and bush fruits in England, the author lays particular emphasis upon the bearing of recent advancement in horticultural and other sciences upon practical operations.

The third report of the State Experiment Orchard, Berri, River Murray, G. QUINN and C. G. SAVAGE (*Jour. Dept. Agr. So. Aust.*, 25 (1922), No. 8, pp. 680, 681, 683-685, 687-689, 691-693, 695-699).—The results of miscellaneous pomological investigations are reported.

As indicated by average yields for the 4-year period ended 1920-21, Royal apricot and Early Crawford peach trees pruned to the "unstopped" leader system gave greater yields than trees pruned back to dormant buds. Moorpark apricot and Elberta peach, on the contrary, responded more favorably to the cutting back method of pruning.

Fertilizer tests with peach, apricot, and orange trees are reported, and indicate in general the superior value of nitrogenous materials. Based upon three seasons' successful experience in wintering over *Blastophaga* insects on fig trees, it is concluded that climatic conditions prevailing in the Murray Valley are favorable to this very important fig pollinator.

In trials of various citrus species as stocks, 3-year tests with eight orange varieties showed that the lemon is a more satisfactory stock in respect to yield of scion than is the sweet orange. The D'Agen prune proved the most consistent bearer and the highest quality variety among the seven tested.

Sulphuring tests with apricots and peaches are briefly reported. The dipping of whole apricots in boiling lye (1 lb. of lye to 30 gal. of water) previous to sulphuring resulted in a much brighter color than that of undipped fruits.

Best parents in various lines of breeding work under way at Ottawa, W. T. MACOUN (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 47-51).—This paper presents a résumé of the breeding activities with the apple conducted at the Central Experimental Farm, Ottawa, since 1895.

Of a total of 71 varieties of apples which have been successfully used as parents in open and in controlled crosses, 33 are represented by seedlings which have reached a fruiting age. Quality in the parent has proved highly essential to obtaining quality in the progeny. In this respect Northern Spy and McIntosh have proved exceptionally valuable parents, and of the two the latter has yielded the larger proportion of promising seedlings. Of 141 trees raised from open pollinated McIntosh seed, 70, or practically 50 per cent, yielded fruit of good or very good quality, with red the predominant color in 103 of the seedlings. A majority, 64.6 per cent, were of early maturity, and the few that showed longer keeping characters than McIntosh were, unfortunately, of inferior quality. Several of the better seedlings, designated as Melba, Joyce, Pedro, Patricia, and Lobo, have been considered sufficiently worthy to be propagated for dissemination. Other varieties of the Fameuse group, including Shilawassce and Winter St. Lawrence, have yielded some seedlings of good quality. Fameuse itself has proved, however, a poor parent when open pollinated, but when crossed with Lawver has yielded some long keeping seedlings of merit.

The Portia strawberry, a seedling of William Belt, is considered very promising.

Results of researches on fruit tree stocks at East Malling, R. G. HATTON (*Jour. Pomol.*, 2 (1920), No. 1, pp. 1-10, pls. 4).—A paper read before the agricultural section of the British Association for the Advancement of Science in August, 1920, briefly summarizing the work with fruit stocks conducted at the East Malling Research Station (E. S. R., 45, p. 741).

Report of the committee on new fruits, C. P. CLOSE (*Amer. Pomol. Soc. Proc.*, 36-37 (1919-1920), pp. 127-178).—Brief data are presented concerning the origin and distinguishing characteristics of varieties of different species of fruits and nuts originated or introduced since the publication of the last committee report in 1907.

Wilder medals, C. P. CLOSE ET AL. (*Amer. Pomol. Soc. Proc.*, 36-37 (1919-1920), pp. 121, 122).—Two fruits, the Golden Delicious apple, awarded the Wilder medal of the American Pomological Society in 1919, and the Temple orange, recipient of the same honor in 1920, are described in connection with data concerning their origin and dissemination.

The planting, cultivation, and general management of orchards in Kent, W. R. ELGAR (*Jour. Roy. Agr. Soc. England*, 82 (1921), pp. 117-131).—As indicated by the title, this is a general account relating to varieties, methods of planting, pruning, harvesting, combating fungus and insect pests, etc.

Fertilization of fruit trees (*Deut. Obstbau Ztg.*, 68 (1922), No. 16, pp. 159, 160).—In this condensed summary, in which no data are presented, the results of fruit tree fertilization experiments conducted by Wagner at Welhenstephan during the years 1907-1921 are reported.

Of the various nutrient materials tested, nitrogen proved to be the most important in influencing the development of leaves, wood, and fruit. The protein and nitrogen content of the leaves increased in accordance with the amount of nitrogen applied. The omission of potassium caused a decline in the quality of the fruit, and the need of nitrogen and potash was clearly indicated by analysis of leaves and twigs. None of the various nutrients used had any apparent effect on the development of scab. Fruit produced in partial shade was not inferior to that produced in exposed situations. The author

believes that the injurious effects of adverse weather may be materially reduced by abundant nutrition.

Storage studies with pears grown on the various fertilizer plats indicated that the nutrients exert a measurable influence on the keeping quality of fruit. The results showed that fruit grown with omission of nitrogen kept 95 days, with the complete formula 89, with no fertilizer 85, with omission of potash 84, with a double application of complete fertilizer 82, and with omission of phosphoric acid 79 days.

Growth of apple seedlings. C. S. GRANDALL (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 13-20).—Extensive records on the germination of seed and growth of apple seedlings of known parentage originated at the Illinois Experiment Station since 1910 have shown some interesting results. Altogether 44 orchard varieties and 47 crab or crablike forms of the genus *Pyrus* (*Malus*) have been used in the breeding activities at the station. Widely divergent crosses, for example Rome Beauty $\times P. floribunda$, Tolman $\times P. toringo$, etc., have succeeded, while other crosses involving *P. soulardi* and *P. ioensis* have failed. In respect to vigor of seedlings, Tolman $\times P. toringo$, Tolman $\times P. atrosanguinea$, and Rome Beauty $\times P. floribunda$ have excelled, while those possessing *P. soulardi* and *P. ioensis* as ovule parents have shown unmistakable signs of constitutional weakness.

Seed obtained by fertilizing flowers of *P. prunifolia* with pollen of Ben Davis, Tolman, Rome Beauty, Oldenburg Domine, and Grimes Golden showed a uniformly high percentage of germination and the 400 trees now living as a result of these crosses are described as remarkably uniform in respect to growth development. The differences between the minimum and maximum in the average height of the six groups of seedlings in their ninth year was only 7.19 in., in spread of top 32.6 in., and in trunk diameter 0.69 in. The average trunk diameters for the six groups were as follows: Rome Beauty 3.87 in., Grimes 3.82, Ben Davis 3.75, Domine 3.55, Tolman 3.54, and Oldenburg 3.18 in.

Root development of the apple as affected by cultural practices. F. P. CULLINAN (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 197-203).—Notable variations were observed in the size and weight of the root and top of 8-year-old Grimes apple trees grown at Laurel, Ind., under three different systems of soil management, namely, tillage, straw mulch, and sod.

Exercising all possible care to secure the entire root system, eight trees were removed from each plat in the summer of 1921. The average weights were as follows: Tillage, entire tree 303.6 lbs., top 230.4, root 73.2; straw mulch, entire tree 250.8, top 186.4, root 64.4; sod, entire tree 142, top 10, and root 4.2 lbs. The average gains in circumference of trunk for the three lots of trees for the period 1915-1920 were 5.44 cm. (2.1 in.) for tillage, 5.08 for straw mulch, and 1.15 cm. for sod. The total yield in fruit for the three lots in 1920 was 63 lbs. for tillage, 190.25 lbs. for straw mulch, and none for sod. The greater weight of the tilled trees as compared with the straw mulch trees is believed to be possibly due to the fact that the latter have borne much more fruit, thus limiting vegetative development.

The soil beneath the tilled trees was found to be in much better physical condition at a greater depth than in the other plats, although analysis failed to show any higher nitrogen or organic matter content in the subsoil. The total nitrogen content of the surface layer of soil was lower in the tilled plat than in either of the others, but this variation had caused no apparent decrease in vegetative development of the trees. The main root systems of the tilled trees penetrated to a greater depth than did those of either the other treatments. It was found that beneath the straw mulch the root system was very

shallow, some roots lying on the surface of the soil, with the majority (75 to 80 per cent) present in the upper foot of soil. The root system of sod trees had made but meager development.

That the character of the subsoil is an important factor in the development of the root system of fruit trees was shown by the fact that the roots of 3-year-old trees at La Fayette, Ind., were found to have penetrated to a much greater depth than those of the 8-year-old trees at Laurel.

Among other points, the study is believed to show the inadvisability of shifting the method of soil management in orchards which have been long maintained on the straw mulch plan unless such trees are in an extremely strong vegetative condition.

Water core in apples, G. RIVIÈRE and G. PICHARD (*Jour. Soc. Natl. Hort. France*, 4. ser., 23 (1922), Apr., pp. 174, 175).—Chemical studies of the normal and abnormal tissue of a Calville Blanc apple affected with water core showed the presence of acetaldehyde and ethyl alcohol in the abnormal flesh, accompanied by a decrease in saccharose and glucose content as compared with the normal flesh. The percentage content of acids was practically the same for both portions. An attempt to inoculate healthy tissue with diseased material met with negative results. The brief account is closed with the statement that at the present time there is no known preventive or remedy for water core, a disease sufficiently prevalent in the vicinity of Paris to cause serious losses to the fruit industry.

The determination of pears, L. CHASSER (*Jour. Pomol.*, 2 (1920), No. 1, pp. 11-15, figs. 16).—A brief paper in which are presented suggestions for a classification of pear varieties based on the ratio between the height and breadth of the fruits.

Pruning and nitrogen studies in a devitalized peach orchard, E. C. AUCHTER (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 178-193).—This paper is devoted for the most part to a discussion of the results obtained with five different pruning treatments in a 10-year-old peach orchard at the Maryland Experiment Station. At the initiation of the experiment the orchard in question was in a much devitalized and unproductive condition, as manifested by long main branches bearing only a few short fruiting twigs.

In the early spring of 1920 all trees in the orchard except 40 reserved for the pruning experiment were headed back from 4 to 6 ft., with undesirable limbs cut off entirely in many instances. A thorough dormant spraying with lime sulphur was applied, and just as the buds were breaking each tree was given 1.5 lbs. of nitrate of soda. All trees were treated for borers. The soil was managed throughout the season on a systematic tillage, cover-crop plan. In the second season of the investigation, 1921, exactly the same fertilization and soil management plan was carried out.

In order to obtain accurate information relative to pruning requirements of neglected peach trees, 40 trees scattered throughout the orchard were divided into five groups of eight, each lot containing four Elberta and four Greensboro trees. The following five pruning treatments were compared: (1) Dehorning, in which the main limbs were cut back to stubs 2 ft. in length, (2) moderately heavy pruning, in which the main limbs and side branches were headed back from 4 to 6 ft. and certain unessential limbs removed in entirety, (3) light pruning, in which the ends of the branches were cut back about 1 ft., (4) partial or gradual dehorning, in which one of the main limbs was dehorned, with the purpose of continuing the operation each successive season until the entire tree is cut back, and (5) no pruning except the removal of diseased and broken twigs. In 1921 follow-up pruning, which consisted in the instance of the dehorned trees of thinning and cutting back the dense new growth and in

the case of the partially dehorned in the removal of another main limb, was practiced on all lots except the unpruned trees.

In summing up the results of the experiments, a part of the detailed data of which is given in tabular form, the author believes that the investigation has shown that 10-year-old, devitalized peach trees may be profitably brought back to a productive condition by proper pruning, spraying, and cultural treatments. Of the types of pruning studied, the best results were obtained from (2), moderately heavy. In this case the height of the trees was lowered, a new top was formed, and sufficient vigorous new growth was stimulated throughout the body of the tree to make possible the production of a satisfactory crop. The dehorned trees (1) made a very dense vigorous growth both seasons but set few fruit buds on the long vegetative shoots, leading to the conclusion that this type of pruning is not as satisfactory as (2). Partial dehorning (4) resulted in an unbalanced, irregular growth, since the dehorned limb failed in many cases to make a satisfactory renewal. Light pruning (3) did not stimulate sufficient new growth to lead to the expectation of profitable crops. Trees receiving no pruning showed plainly that peach orchards of the character used in this experiment can not be rejuvenated without pruning. The author attempts to explain the various results of the investigation by reference to recent physiological and nutritional studies.

Experiments with small fruits at Weißenstephan and Peine (Deut. Obstbau Ztg., 68 (1922), No. 16, pp. 158, 159, 160)—Miscellaneous experiments in small fruit culture are reported.

The application of a complete fertilizer to red and black currants growing in relatively rich soil proved profitable. The omission of any one of the component elements resulted, however, in reduced yields, and in the case of large red currants a decrease in potash caused a greater reduction in yield than did a corresponding decrease in phosphoric acid. Although red currants responded at first to nitrogen, this need was soon supplied by the natural fertility of the soil. Nitrogen proved of prime importance to black currants, while potash was of less value and phosphoric acid practically of no benefit. Whinham Industry gooseberry responded quickly to potash and phosphoric acid, with nitrogen proving of little value.

Determination of the sugar content in red currant fruits produced on plats receiving different fertilizer treatments showed with complete fertilizer 18.9 per cent, omitting nitrogen 16.4, omitting phosphoric acid 16.3, omitting potash 15.9, and no fertilizer 13.8 per cent. Leaves of plants (red currants?) receiving no potash showed a potassium content of 0.64 as compared with 1.4 per cent for the complete fertilizer treatment, leading the author to conclude that plants utilize potassium in widely different amounts.

The influence of fertilizers on gooseberries is shown by the following yield data obtained at Weißenstephan from 1908 to 1919: (1) Complete fertilizer 1.09 kg. per bush, (2) omitting nitrogen 1.48, (3) omitting phosphoric acid 1.07, (4) omitting potash 0.99, and (5) no fertilizer 1.08 kg. The apparent deleterious effect of nitrogen is accounted for by the richness of the soil, the author believing that the addition of chemical nitrogen promoted an unbalanced nutritional condition which resulted in decreased yield.

Strikingly different relationships were recorded between root and top growth in various species of bush fruits. In the red currant the tops averaged 167 gm. and the roots 404; the gooseberry, top 98, roots 248; and the black currant, top 281, roots 129 gm. These extraordinary differences in species indicate a marked superiority on the part of the red currant and gooseberry to penetrate the soil in search of food.

A note on the fruiting habit of the Concord grape, N. L. PARTRIDGE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 193-196).—Records obtained on the weight of fruit produced by the shoot or shoots emanating from the nodes of bearing canes of 48 Concord grapevines growing near Grand Rapids, Mich., indicated a distinct correlation between position of shoot in reference to base of cane and yield of fruit. The optimum production was found in shoots arising at the sixth node, with comparatively high yields for shoots borne at the fourth, fifth, seventh, and eighth nodes; however, when allowance was made for barren shoots and undeveloped buds, a shift in optimum production toward the base of the cane was noted, the maximum production occurring at the fourth node. A frequency table showing the average yield per node of the canes grouped according to the number of buds (1 to 14) shows that those canes containing 8 to 9 buds are superior in respect to average yield per node than those bearing a greater or a lesser number of buds.

Grape stocks for heavy calcareous soils, H. FAES and P. TONDUZ (*Ann. Agr. Suisse*, 23 (1922), No. 1, pp. 13-16).—With the object of determining the adaptability of various stocks to heavy calcareous soils, various forms were planted at Arnex-sur-Orbe, Switzerland, in 1909, in a soil which is described as of such a difficult nature that when wet it clung tenaciously to the tillage instruments and when dry was quickly subject to cracking. From 48 to 60 per cent of very fine and easily assimilated lime was present in the soil. Earlier plantings made about 1895, including such stocks as Riparia Gloire and Riparia × Rupestris 101st had failed completely, while, on the other hand, Mourvèdre × Rupestris 1202 had given satisfactory results in many places. The climate of the region is described as very harsh.

Calcephobous stocks were included in the test in small lots merely to determine how long they might survive under disadvantageous conditions, while other stocks more resistant to lime were included in much greater number. The Chasselas variety was used as scion in all cases. Of the various stocks included in the test, comprising pure Americans, Americo × Americans, and Franco × Americans, three of the last group, namely, Mourvèdre × Rupestris 1202, Chasselas × Berlandieri 41 B, and Cabernet × Berlandieri 333, showed particular ability to endure and thrive in the type of soil above mentioned. Riparia × Berlandieri 157th, and Riparia × Berlandieri 34 E, although not containing any Vinifera parentage, made satisfactory growth.

Preliminary report on the use of sodium silicate (water glass) as a wound dressing, W. J. YOUNG (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 196, 197).—A test conducted at the South Carolina Experiment Station of various media for the treatment of pruning wounds on the Muscadine grape indicated that an application of hot sodium silicate solution is effective in preventing bleeding, which when pruning is practiced later than January 1 often causes serious injury to the vines.

Orange culture in Tunis, L. GUILLOCHON (*Vie Agr. et Rurale*, 18 (1921), No. 2, pp. 28-30, fig. 1).—This is a general account relating to the location of the industry, methods of culture practiced, varieties grown, etc.

Orchid hybrids: Sander's complete list (*St. Albans, [Eng.]: Sanders, 1921, [2. ed., rev. and enl.], pp. [XI]+225*).—A complete list arranged in tabular, alphabetical form, containing the names and parentage of all known orchid hybrids, whether of natural or artificial origin.

The American rose annual, 1922, edited by J. H. McFARLAND (*Harrisburg, Pa.: Amer. Rose Soc., 1922, pp. 192, pls. 18, figs. 10*).—Similar to those of previous years (*E. S. R.*, 45, p. 348), this volume, containing articles by various authors, constitutes a record of progress in rose culture in North America in 1921.

In the paper entitled Dr. Walter Van Fleet, American Rosarian and Plant Hybridist (pp. 13-22), considerable data are contributed concerning the life and activities of this eminent plant breeder (E. S. R., 46, p. 199), including a brief account of the origin and dissemination of the Dr. W. Van Fleet climbing rose.

FORESTRY.

Effect of a late spring frost upon forest vegetation in the Wasatch Mountains of Utah, C. F. KORSTIAN (*Ecology*, 2 (1921), No. 1, pp. 47-52, fig. 1).—The information contained in this paper is based on notes taken on the injury to forest trees in the Cottonwood Nursery, located 25 miles southeast of Salt Lake City at an elevation of 7,400 ft., following an unusually severe freeze which occurred in late May, 1919. On the night of May 30, following a fall of 5 in. of snow, the temperature dropped to 15° F., causing serious injury to the vegetation which had been forced by a period of unusually hot weather.

In general, the pines, although described as renewing their growth much earlier in the season than other conifers, were not injured, while the spruces and firs, which had developed appreciably, were frozen in varying degrees. Four-year old *Picea engelmanni* one year transplanted suffered severely, a few of the trees being killed to the ground, while 3-year-old plants of the same species still growing in the seedling beds were only slightly injured. Stock grown from seed collected on the Gunnison National Forest in Colorado did not have over 10 per cent frozen terminals, as compared with 50 per cent for plants of the same species grown from seed gathered in the vicinity of the nursery. Coverings of hay afforded a high degree of protection to both 4- and 2-year-old plants.

Two-year-old *P. parryana* trees were practically unhurt except along the edge of the beds, while 4-year-old plants, two years transplanted, had approximately 10 per cent of their terminals killed. The layer of snow is thought to have been more beneficial to the younger and smaller stock. Trees of *Pseudotsuga larifolia* two years in the seed bed and two years transplanted were quite severely injured even when protected with a layer of hay, and uncovered beds were rendered practically worthless. *Pinus ponderosa* showed greater resistance and was in all cases uninjured. *P. contorta* and *P. monticola* suffered but little injury. Norway spruce (*Picea excelsa*) exhibited much greater resistance than did the native blue species.

The firs, Douglas, alpine, and white, suffered more extensively than did the spruces. The aspen *Populus tremuloides* not only had its current but also most of its previous season's growth killed. Nevertheless, new growth characterized by excessively large leaves was soon put forth from adventitious buds. Box elder, alder, mountain ash, maple, Gambel oak, and elder were seriously injured, and of the many shrubs examined, *Pachystima myrsinites* was the only one found unharmed.

Some notes on trees of the Sierras, L. H. PAMMEL (*Ames Forester*, 10 (1922), pp. 45-57, figs. 3).—Brief descriptive notes of a somewhat popular nature are given of the various California tree species, especially those occurring in the Yosemite Valley.

Ray volumes of the commercial woods of the United States and their significance, J. E. MYER (*Jour. Forestry*, 20 (1922), No. 4, pp. 337-351).—This is a report of an anatomical study, the object of which was to determine the correlations existing between variations in ray volume in different woods and their physical properties, inheritance, and conditions under which grown. Approximately 92 species were studied, of which 38 classed as soft woods had

an average ray volume of 78 per cent and 54 species classed as hardwoods an average of 17.04 per cent.

The greater ray volume found in trees grown in low swampy ground as compared with those of the same species grown on uplands indicated that site is an important factor. Trees growing under suppressed conditions due to encroaching neighbors showed a reduced amount of storage tissue. It is believed that the larger variations in volume of rays in different species of woods are due to inheritance, while the lesser variations are the result of differences in site, climate, temperature, soil, age, and the ability of the leaves to assimilate food. Trees with uniseriate, diffused, and compound rays showed an increasing ray volume in the order given. Little connection was observed between ray volume and genetical relationship. Among the conifers, *Thuja occidentalis* possessed a minimum ray volume of 3.4 per cent and *Pinus heterophylla* a maximum of 11.7 per cent, while in the dicotyledons *Tilia heterophylla* was lowest with 5.3 per cent and *Quercus densiflora* highest with 42.26 per cent.

A critical revision of the genus Eucalyptus, V. J. H. MAIDEN (*Sydney, N. S. Wales: Govt., vol. 5 (1920-1921), pts. 1-10, pp. 1-333, pls. 40*)—In conformation with previous volumes (E. S. R., 43, p. 543), 81 odd species of Eucalyptus are minutely described with supplementary information concerning synonymy, geographical distribution, etc.

Forestry for woodmen, C. O. HANSON (*Oxford: Univ. Press 1921, 2. ed. [rev. and enl.], pp. 238, pls. 12, figs. 16*).—A revised and slightly enlarged edition of a previously noted English handbook (E. S. R., 27, p. 41).

Report of the State forester [New Jersey], A. GASKILL (*N. J. Dept. Conserv. and Development, Ann. Rpt., 1921, pp. 53-70, pls. 4*).—A progress report for the year ended June 30, 1921 (E. S. R., 45, p. 840). An important event of the year was the appointment of a trained forester as manager of a 100,000-acre tract of privately owned and hitherto neglected woodland in Burlington, Atlantic, and Camden Counties. Observations on plantations on Bass River and Lebanon State Forests showed southern loblolly pine to be a desirable species on account of its rapid and straight growth. A list of community shade tree commissions, with data concerning their revenues and activities, is presented in tabular form.

Report of the State firewarden [New Jersey], C. P. WILBER (*N. J. Dept. Conserv. and Development, Ann. Rpt., 1921, pp. 71-87, pls. 2*)—Due to the intense and long-continued drought occurring in May and June, 1921, the fire hazard was greatly increased, with the result that more damage was done in this short period than usually occurs in 12 months. On the other hand, the number of fires (554) occurring during the calendar year 1920 was less than the average of the last decade. This variation caused by differences in the amount of moisture illustrates the very close relationship between weather and forest fires. Two new lookout towers were placed in commission during the year. Statistical data on the extent and number of forest fires occurring during the calendar year 1920 are given.

Eleventh annual report of the State forester to the governor for the year ending December 31, 1921, F. A. ELLIOTT (*Oreg. State Forester Ann. Rpt., 11 (1921), pp. 29*).—This is the usual annual report (E. S. R., 46, p. 340).

Report of the director of forestry for the fiscal year ended March 31, 1921, R. H. CAMPBELL ET AL. (*Canada Dept. Int., Rpt. Dir. Forestry, 1921, pp. 46, figs. 12*).—In a similar manner to those of the previous years (E. S. R., 46, p. 141), this report, in addition to a record of the activities of the forestry branch of the Canadian Department of the Interior for the fiscal year ended March 31, 1921, contains various subreports, that of the chief of the tree

planting division, those of the district forest inspectors for Manitoba, Saskatchewan, Alberta, and British Columbia, and that of the superintendent of the Forest Products Laboratories of Canada.

The total number of fires occurring during the fiscal period was 1,532, as compared with 1,313 for the preceding season. Of the 485,500 acres burned over, 110,000 were comprised of commercial timber, 152,600 of young growth, and the balance of open or grazing lands. Airplanes were used for the first time in forest protection in western Canada.

Afforestation of ravine lands in the Etawah District, United Provinces. E. A. SMYTHIES (*Indian Forest Rec.*, 7 (1920), No. 8, pp. 33, pls. 18, fig. 1).—An account of the methods employed, forest tree species utilized, and successes finally obtained in an afforestation project in India, wherein the broken and erodible nature of the soil rendered operations exceedingly difficult. Works of this kind are deemed of great value, not only in furnishing labor to the natives in times of famine but also in the reestablishment of grazing lands and in supplying fuel to the people.

DISEASES OF PLANTS.

Check list of station publications of the State agricultural experiment stations on the subject of plant pathology, 1876-1920 (*U. S. Dept. Agr., Library Bibliog. Contrib. No. 2* (1922), pp. [205]).—This publication, compiled by E. R. Oberly and J. M. Allen, is a mimeographed list of references to plant disease literature found in experiment station reports, bulletins, circulars, and press bulletins, so far as they are found in permanent form, but not extension publications. It is discussed editorially on page 307 of this issue.

[Report of the] division of plant pathology and botany, E. M. FREEMAN ET AL. (*Minnesota Sta. Rpt.* 1921, pp. 72-77).—Brief progress reports are given of investigations carried on by various members of the staff.

Particular attention is being given to the study by E. C. Stakman et al. of cereal rusts, and results of experiments in breeding for rust resistance show definite progress is being made. Several promising wheat hybrids and selections have been produced that are resistant to stem rust, and at the same time they appear to have desirable agronomic characters. Studies made of the genetics of rust resistance are believed to show that the spring habit of Marquis wheat can be combined with the rust resistant habit of Kanred. Continued study of the biologic specialization of cereal rusts indicates that there are at least 33 distinct forms of stem rust. In investigations of the epidemiology of cereal rusts, evidence has been obtained that seem to indicate that summer spores do not live over winter and spring, but that the rust on wheat comes mainly from infected barberries. The campaign for the eradication of barberry bushes is being actively pursued.

In the work reported on other diseases of cereals and forage plants, it is shown that flax, resistant to wilt, did not lose this character to any appreciable degree after having been grown for two years on clean soil. Marked differences in susceptibility to foot and root rot and seedling blight have been found in varieties of wheat, barley, and rye. A strain of *Helminthosporium* isolated from rye was found to infect a considerable number of varieties of wheat, barley, rye, and grasses, while several varieties of oats and a number of grasses were immune to it. The susceptibility of various cereals to smut, bunt, and scab is being tested.

In studies on truck-crop diseases by J. G. Leach evidence has been found indicating two biologic forms of the bean anthracnose fungus. Experiments

have shown the superiority of potatoes from sprayed vines when used for seed purposes the succeeding year, and the advantage is attributed to the repellent action of Bordeaux mixture on aphids, thus preventing the infection of potatoes by mosaic. For the control of black scurf of potatoes corrosive sublimate treatment gave slightly better results than did the use of formaldehyde or copper sulphate.

Preliminary experiments by J. L. Seal for the control of apple diseases with dust fungicides are said to have given results that warrant a further trial of this method of applying fungicides.

Outlines are given of a number of investigations begun on plant metabolism and growth, by L. I. Knight and C. L. Farabaugh, and by R. B. Harvey on respiratory enzymes, physiology of seed germination, effect of low temperature on plants, etc. Data have been secured which seem to indicate an increase in amino acids in leaves in autumn, and that the amino acids have an important rôle in preventing the precipitation of proteins.

Preliminary tests of the effect of low temperatures on first-year wood of plums showed wide varietal differences in the degree of cold required for killing. Browning of the tissues, which takes place after about 24 hours, was found a reliable index of winterkilling.

Two serious plant diseases new to the Philippines. C. G. WELLES (*Philippine Agr.*, 10 (1921), No. 5, pp. 253, 254).—Anthracnose (*Colletotrichum gosypii*) is reported as recently found on cotton bolls at the College of Agriculture, but had not been noted at any other point in the Philippines.

The very serious sweet potato leaf spot (*Cercospora batatae*) reported by Reinking from southern China, in an account covering that region (E. S. R., 45, p. 647), has been found on sweet potato at the college.

Plant pests and diseases. O. HEUFER (*Deut. Landw. Presse.* 48 (1921), No. 64, pp. 473, 474).—A condensed account is given of practical experiences and observations in connection with diseases of economic plants.

Some problems of economic biology in East Africa (Kenya Colony). W. J. DOWSON (*Ann. Appl. Biol.*, 8 (1921), No. 2, pp. 83-100, fig. 1).—A discussion is given of economic problems in East Africa connected with the coconut palm (*Cocos nucifera*), including bud rot or heart rot (*Phytophthora palmivora*) or possibly bacteria; with sisal hemp (*Agave rigida sisalana*), including the ring spot disease (*Colletotrichum agaves*); with coffee (*Coffea arabica* and *C. nandiensis*), including *Hemuleia vastatrix*, *Cercospora coffeicola* (*Septoria maculosa* ?), *Colletotrichum coffeanum*, *Diplodia* sp., *Phoma* sp., and *Phomopsis* sp.; with the East African cedar (*Juniperus procera*), including a heart rot (*Fomes juniperinus*); with *Brachylaena hutchinsii*, including a seedling disease (*Sclerotinia* sp.); with citrus varieties, including foot rot (*Fusarium* sp.) or perhaps bacteria, and bacterial leaf spots; with wheat, including black stem rust (*Puccinia graminis*), yellow rust (*P. glumarum*), and brown or leaf rust (*P. triticea*); and with flax, including *F. lini*. A few insect pests are also mentioned.

Dry gummosis in plants. L. SAVASTANO (*R. Staz. Sper. Agrumic. e Fruttic. Aircale*, Bol. 41 (1921), pp. 5-7).—The year 1920, marked in Sicily by dryness, showed also in certain economic plants a dry form of gummosis. This reappeared in 1921, and may be connected with neglect consequent upon war conditions.

Influence of temperature on the development of mosaic diseases. S. P. DOOLITTLE (*Abstr. in Phytopathology*, 11 (1921), No. 1, pp. 46, 47).—Preliminary experiments are said to indicate that temperature may have an important bearing on the development of mosaic diseases.

Cucumber plants inoculated with mosaic disease and grown in soil temperatures of from 18 to 30° C. developed mosaic at temperatures of 22 to 27°, but increasing the temperature from 27 to 30° reduced the incubation period and produced a higher percentage of infection accompanied by symptoms of a new type. In a few cases mosaic developed at a soil temperature of 18° when the air temperature was above 20°, but with a lower air temperature the diseases did not develop.

Overwintering of mosaic of annuals. J. A. McCLINTOCK (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 47).—Attention is called to the fact that mosaic diseases of potatoes, sugar cane, and other plants may be carried over in the living root or stem, but the question is raised as to how the disease-producing entity is carried over winter on annual plants where the root dies and the seed does not seem to carry it.

Overwintering of mosaic on species of *Physalis*. R. F. CRAWFORD (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 47).—The author reports the occurrence of mosaic on *Solanum dulcamara*, *S. nigrum*, *P. longifolia*, *Nicandra physaloides*, and *Datura stramonium* in Iowa. The disease was readily transferred to tomatoes and peppers.

Some observations on the life history of *Nectria galligena*. D. M. CAYLEY (*Ann. Bot. [London]*, 35 (1921), No. 137, pp. 79–92, pls. 2).—In a study aiming to find the most vulnerable stage of *N. galligena*, involving a complete investigation of the life history of the fungus and more particularly of the transition from the summer or conidial to the resting or perithecial stage, it was found that the fungus will complete its life cycle on media containing starch or a derivative thereof with 1 per cent glycerin. A few supposedly hitherto unrecorded observations are noted. Besides the three different forms of spores previously known, a fourth form, a two-celled multinucleate spore, was observed. No conclusive evidence was obtained that pycnidia occur in the life history of *N. galligena*.

Studies in the physiology of parasitism.—VI, Infection by *Sclerotinia libertiana*. C. BOYLE (*Ann. Bot. [London]*, 35 (1921), No. 139, pp. 337–347, pl. 1).—Continuing this series (*E. S. R.*, 43, p. 46), the author has studied the early stages of infection of bean leaves by *S. libertiana*.

The hyphae of the ordinary mycelium and also the appressoria growing in turnip juice are surrounded by a mucilaginous sheath, which can not always be demonstrated in case of aerial hyphae. When a hyphal tip comes in contact with any resistant material, such as a cover slip or the host surface, the staining reaction of the wall of the tip becomes modified, this modification extending a short distance behind the point of contact and being very strongly marked in case of the appressoria. From the tip of each hypha which is in contact with the host plant or with a glass surface there arises an infection hypha, usually very narrow, which under appropriate conditions penetrates the host. The infection hypha shows a normal unmodified wall. The cuticle may be markedly indented at the point of contact with the fungal hypha, this indentation being due to the pressure exerted by the infection hypha. The invading hyphae are apparently fixed to the cuticle by means of the mucilaginous sheath. There is no evidence at this stage of the softening or solution or any other modification of the cuticle or subcuticular layers of the host, the rupture of the cuticle by the infection hypha being due apparently to mechanical action only. After the cuticle has been penetrated the tissue beneath rapidly becomes disorganized, this condition extending for some little distance in advance of the infection hypha.

Under similar conditions the penetration of the host may take place with or without the formation of appressoria. The method of hyphal mass infection

displayed by *S. libertiana* is thus physiologically similar to that of infection by *Botrytis cinerea* and *Colletotrichum lindemuthianum*.

Bacterial leaf spot of Lima bean, W. B. TISDALE and M. M. WILLIAMSON (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 52).—A hitherto unreported bacterial disease of Lima beans observed at Madison, Wis., since 1917 is described. The disease appears early on young plants, and observations indicate that its further spread may be checked by dry weather. Leaves, stems, and pods are affected. It is believed probable that the organism, which is a white, aerobic bacterium, is carried over winter on the seeds.

Seed transmission and overwintering of cabbage black rot, J. MONTEITH, JR. (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 53, 54).—It is believed probable that the organism causing cabbage black rot lodges on the seed coats during threshing and is carried over in this manner to the next season. Clean seed, sown in sterilized soil that had been mixed with diseased cabbage leaves, yielded seedlings with a high percentage of infection. Artificially inoculated seed, allowed to dry three days and planted in sterilized soil, also yielded seedlings with a large percentage of cotyledon infection. Evidence is said to indicate that climatic factors during seed-bed growth are important in determining the rapidity of the spread in the seed bed, and consequently the severity of epiphytotics.

Greenhouse propagation of cabbage resistant to yellows, J. C. GILMAN and A. T. ERWIN (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 54).—Results are given of an experiment carried on in the greenhouse for the development of cabbage resistant to yellows. This experiment was conducted with types of early cabbage which could not be satisfactorily stored through the winter. The best strains developed in 1920 showed a high degree of resistance.

Celery yellows, G. H. COONS and R. NELSON (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 54, 55).—The authors report a stunting disease of celery first observed in Michigan in 1914, due to a new species of *Fusarium*.

Recent studies on bacteriosis of celery, R. F. POOLE (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 55).—A soft rot of celery is described, in which the causal organism differs only in a few minor cultural characters from other soft rot organisms, *Bacillus carotovorus* and *B. apvorus*, and the author believes that they are all probably different strains of the same organism.

Bacterial leaf spot of red clover, L. R. JONES and M. M. WILLIAMSON (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 50).—A bacterial leaf spot on the red clovers, both *Trifolium pratense* and *T. medium*, is reported in Wisconsin and is thought to occur widely elsewhere. The most characteristic effect is on the leaf blades, but the parasite may also attack the petiole, stipule, and stem. The organism is believed to overwinter in the crown or bud of the plant and is chiefly disseminated by the spattering of rain. A complete description of the organism is promised.

Dry rot of corn, I. E. MELHUS and L. W. DURRELL (*Iowa Sta. Circ.* 78 (1922), pp. 8, figs. 8).—A popular description is given of the dry rot of corn due to *Diplodia zeae*, and suggestions are offered for its prevention or elimination.

A new Phoma disease of cotton, J. A. ELLIOTT (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 48).—An unreported Phoma disease of cotton is said to have appeared in west-central Arkansas in June, 1920. The disease made rapid progress during a period of cool, wet weather, all the plants being killed in small areas where infection was severe, and in other cases the stand was greatly reduced. The fungus has been isolated and successful inoculations made both on wounded and unwounded tissues. High humidity appears to be essential to the spread and progress of the disease.

Bremia on hothouse lettuce, I. E. MELIUS (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 54).—It is claimed that lettuce in greenhouses in Iowa often suffers serious losses due to *B. lactucae*. The fungus also attacks a number of wild species of lettuce, and the importance of these species as hosts on which the fungus is carried over is pointed out.

Development and pathogenesis of the onion smut fungus, P. J. ANDERSON (*Massachusetts Sta. Tech. Bul.* 4 (1921), pp. 95–133, figs. 6) —An investigation of onion smut with special reference to better methods of control was begun by the department of botany of the station in 1918. The present publication gives an account of certain phases of the life cycle of the causal organism (*Urocystis cepulae*) which it seemed desirable to investigate. Germination difficulties are noted, with an extended account of this phase of the work and of the related literature. A study was made of the infection of onion by *U. cepulae*, also of its incubation period and sporogenesis.

It is claimed that *U. cepulae* lives and grows as a saprophyte indefinitely in the soil, its growth being favored by the presence of manure. It derives sufficient nutritive materials from the soil to grow and spread extensively during this stage. It enters the soil either as spores or as mycelium from the buried parts of diseased onions, and probably lives in the soil for years without the presence of onions. Infection may take place directly by mycelium, and the presence of spores is not necessary. The number of years which must elapse before onions can be safely grown on infested land is determined in all probability by the length of time during which the mycelium can continue to live and develop saprophytically without having to pass again through a parasitic stage.

The organism may be grown in pure culture on a wide range of media. Sugar greatly increases growth in the media and this probably accounts for its rapid growth in the host. Starch is a very poor carbon source. Decoctions from soil or manure furnish all the essentials for growth, which is checked by a small amount of acid. Freezing does not kill the mycelium. No sporidia (conidia) were found on pure cultures or in soil.

Infection may occur during the time from the second day after the seed germinates until about the time that the first leaf appears on the side of the cotyledon, after which the plant is immune. Infection occurs only through the cotyledon, and any part of its epidermis may serve as the point of infection. The infecting hypha bores directly through the outer wall of the epidermal cell, forms a hyphal guard inside the cell, and then passes through the inner wall into the intercellular spaces where it grows during the rest of its development. Many infections may occur on the same cotyledon. The incubation period is less than a week. Large complicated haustoria are formed within the host cells. An infected plant recovers if the fungus fails to reach the growing zone, but if it once becomes established in this zone, the plant never recovers, and most if not all the leaves will contain lesions. At the close of the incubation period the mycelium is in dense masses between the cells, and from this spores develop in soil. Further developmental features are described.

The occurrence of dodder on onions, J. C. WALKER (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 53).—Three instances are cited of dodder (*Cuscuta* sp.) attacking onion tops in California, Wisconsin, and Illinois.

A Macrosporium rot of onion, J. C. WALKER (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 53).—An undescribed bulb rot of onion was noted on white varieties of onions in Wisconsin and Illinois. Isolations from diseased bulbs yielded a species of *Macrosporium*, and the disease was readily produced by inoculation of healthy bulbs.

[**Potato disease control**], C. G. SELVIG (*Minnesota Sta. Rpt. 1921, p. 95; Crookston Substa. Rpt. 1920, pp. 60, 61*).—Tests of homemade Bordeaux mixture (5-5-50), beginning July 1 and repeated at intervals of 10 to 14 days, showed yields corresponding to the control and to the number of sprayings, of 70, 75, 82.5, 97.5, 95, and 112 bu. per acre. Potatoes on sprayed plats stood drought much better than those on unsprayed plats. The tonic effect of the spray was marked. Treatments with corrosive sublimate and formalin of seed tubers showing black scurf and scab resulted in scab being almost eliminated by both fungicides. Scurf was less affected by corrosive sublimate and hardly at all by formalin.

[**Potato disease investigations**], T. M. McCALL (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 106-109, 111, 112, 114*)—Summary reports are given of the results of several years' experimentation on the control of various potato diseases.

Treating tubers before they were cut for planting, either with corrosive sublimate solution or formalin for the control of scab, resulted in largely increased yields over no treatment, and treatment before cutting gave better results than treatment after cutting.

Corrosive sublimate treatment gave satisfactory control of black scurf (*Rhizoctonia*) and materially reduced the amount of blackleg and *Fusarium* wilt. Treatment with corrosive sublimate, roguing diseased plants from the field, and long-time rotations are believed to offer satisfactory methods for the production of disease-free potatoes.

Spraying experiments carried on over a number of years have shown the advantage of the use of Bordeaux mixture for the control of the common diseases of the potato plant in the Red River Valley. The results of experiments in which from one to five applications of 5-5-50 Bordeaux mixture were used indicate a decided increase in yield where three sprayings were employed. In most years no additional advantage was found for the greater number of sprayings.

Lime-sulphur mixtures were tested in comparison with Bordeaux mixture, but none of the treatments described were as efficient in increasing yields as the Bordeaux mixture applications.

The pathogenicity of *Corticium vagum* as affected by soil temperature, B. L. RICHARDS (*Abstr. in Phytopathology, 11 (1921), No. 1, p. 56*).—Field and greenhouse studies are said to have shown that the temperature of the soil is a vital factor in determining the degree to which the potato and other crops may be damaged by *C. vagum*. The fungus may produce lesions on the underground stems of the potato plant in soils ranging in temperatures from 9 to 29° C. Severe damage, however, is limited to soil temperatures below 24°, and the destruction of the growing points of the young shoots does not occur at soil temperatures above 21°. Experiments with the potato, pea, and bean are said to indicate that the temperature requirements for the pathogenic action of the fungus on these hosts is determined by a fixed physiological character of the fungus, and is but slightly influenced by the temperature relations of the hosts.

Studies in parasitism in the *Fusarium* group, H. C. YOUNG and C. W. BENNETT (*Abstr. in Phytopathology, 11 (1921), No. 1, p. 56*).—Experiments with *F. oxysporium* are said to show that wilting of potato plants when attacked by this fungus is not due to the mechanical plugging of the vascular tubes, but to certain products of the fungus acting on the host tissue.

Cooperative seed treatment using hot formaldehyde, R. H. PORTER (*Abstr. in Phytopathology, 11 (1921), No. 1, p. 59*).—It is reported that cooperative treatment of seed potatoes has been successfully practiced in Iowa, farmers

organizing seed-treatment centers and using creameries or steam engines as sources of heat. In one case more than 530 bu. were treated in less than six hours.

The cooperative potato spraying project, G. R. RISBY (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 60).—A brief outline is given of a cooperative potato-spraying project which is being carried on by plant pathologists and entomologists in a number of regions of the United States and in Canada.

Testing seed potatoes for mosaic and leaf roll, F. M. BLODGETT and K. FERNOW (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 58, 59).—Attempts have been made to eliminate potato mosaic and leaf roll from small lots of seed by growing one tuber from each hill as an index to the entire hill, and by growing one eye from each tuber as an index to the remainder of the tuber. In several lots of hill units, only single-stalk hills were selected.

In a limited number of tests there was nearly as large a percentage of mixed-hill units, part mosaic and part healthy, in the progeny of single-stalked hills as in hills with a number of stalks. Only small decreases in the percentage of mosaic were obtained by sorting out the hills on the basis of the greenhouse test of one tuber to each hill. Considerable reduction was secured on the basis of testing an eye from individual tubers.

Cooperative potato seed treatment experiments, I. E. MILLER (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 59, 60).—A report is given of cooperative seed treatment experiments for the control of *Rhizoctonia solani*, carried out by the Iowa, Wisconsin, and Minnesota Experiment Stations in 1919, and the Iowa and Wisconsin Stations in 1920. Formaldehyde, copper sulphate, and corrosive sublimate were used, the seed being treated in various ways by each station and then divided so that in 1919 each station had plots of the various treatments of their own and the other two stations' seed.

The Minnesota seed at Minnesota showed that copper sulphate gave less control than hot formaldehyde, but the reverse was the case under Iowa conditions. Corrosive sublimate gave better control than copper sulphate, but not as good as the hot formaldehyde at Minnesota, and was poorer than either at Iowa. At Wisconsin the corrosive sublimate and the hot formaldehyde were found about equally efficient, the copper sulphate giving the poorest results.

With Wisconsin seed at Wisconsin corrosive sublimate for 1.5 and 2 hours gave the best control, while formaldehyde gave practically none. At Iowa the hot formaldehyde treatment equaled the corrosive sublimate treatment for 1 hour, although it was not as good as the 1.5 and 2 hour treatment with the latter solution.

The Iowa seed at Minnesota showed good control of the disease with both the hot formaldehyde and the corrosive sublimate treatments, although the former was slightly better in Minnesota as well as in Iowa. The reverse was the case in Wisconsin.

In 1920, when Iowa and Wisconsin alone cooperated, Wisconsin seed at Wisconsin showed excellent control when treated with corrosive sublimate and practically none with formaldehyde, either hot or cold. At the Iowa Station cold formaldehyde gave the best results, with hot formaldehyde second, and the corrosive sublimate treatment third. Copper sulphate treatment was ineffective at either station. Iowa seed at the Wisconsin Station showed the best control with corrosive sublimate, second with cold formaldehyde, and poorest with hot formaldehyde. At the Iowa Station hot formaldehyde gave the best results.

Inoculated sulphur for potato scab control, R. E. VAUGHAN (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 58).—It is said that the use of inoculated

sulphur, "Bac-sul," for the control of scab in Wisconsin in 1920 was not successful.

Tipburn and the leafhopper, G. P. BURNS (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 56, 57).—Attention is called to the effect of screens for the reduction of solar radiation, wind velocity, humidity of the air, evaporation, and transpiration, and the possible bearing of these factors on tipburn of potatoes attributed to leafhoppers.

Catalase, hydrogen-ion concentration, and growth in the potato wart disease, F. WEISS and R. B. HARVEY (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 57).—Studies of the hydrogen-ion concentration and catalase activity in the overgrowths of the tubers of Irish potatoes caused by infection by *Chrysophlyctis endobiotica* showed that the hydrogen-ion concentration was higher in the wart tissue than in healthy tubers of the same plant.

Stem rot of sunflowers in Manitoba, G. R. BISBY (*Sci. Agr.*, 2 (1921), No. 2, pp. 58–61, figs. 3; *abs. in Phytopathology*, 11 (1921), No. 1, p. 49).—During 1920 and 1921 considerable importance was attained by a sunflower disease, which might appropriately in most cases be called either (surface) stem rot, wilt, or crown rot from its behavior. This trouble is ascribed to a fungus corresponding closely to *Sclerotinia libertiana*, though not definitely determined by the present author. In Manitoba, though no extensive survey has been made, the disease has been found at the agricultural college, Charleswood, Clandeboye, Brandon, and Morden. It was studied during 1920 and 1921 at the college, where it appeared on August 1 and July 17 of these respective years. The symptoms and behavior are described. The disease spreads rapidly in the field. The losses, though considerable, are not known to increase from year to year.

The *Sclerotinia* overwinters in the soil at least, but apparently not in the seed, which, however, are rarely produced in diseased plants.

Tests regarding other hosts by inoculation of other plants during the short period of study showed positive results with carrot, parsnip, and potato tuber (onion rotting slightly), but not with maize plants.

A study of the control of crown gall on apple grafts in the nursery, I. E. MELHUS and T. J. MANEY (*Iowa Sta. Research Bul.* 69 (1921), pp. 159–172).—In a previous bulletin (E. S. R., 41, p. 348), Greene and Melhus have shown the undesirability of setting orchard trees infested with crown gall, stating that trees galled on the union or on the stock make the poorest growth. With the object of decreasing or preventing the large losses indicated as due to the general distribution of crown gall in the United States, studies were undertaken on the susceptibility and infection of host tissues under various conditions, and on the influence of disinfectants and fungicides in preventing the development of crown gall.

It is stated that the infection of apple grafts is readily accomplished by dipping the grafts just before planting in a culture of *Bacterium tumefaciens*. Apple grafts, whether well or poorly made, usually appear about equally susceptible to the crown gall organism where the callus is normal, excessive, or slight. Use of an unusually large amount of string over the union of the grafts leads to girdling and excessive callusing of the trees to a degree which seems to facilitate crown gall infection. Cloth applied over the union as a wrapper, either with or without string, decreases the amount of crown gall. Scion wood cut from trees infected with crown gall at the union did not show increase of crown gall. Hairy root seedlings, when used as stock, did not transmit hairy root to the scion, but the stock portion of the graft remained infected in most cases. Most of the crown gall infection takes place at the union during the first year. Surface disinfection with formaldehyde (0.16 per cent), copper sul-

phate (0.25 per cent), and mercuric chlorid (0.1 per cent) while the callus was forming seriously injured the callusing of apple grafts. Fungicides which go into solution slowly, such as lead arsenate and Bordeaux mixture, have a much less injurious effect on the callusing process.

A strong Bordeaux mixture (25-25-50) decreases the stand, seems to have a preserving action on the string, and reduces the amount of crown gall. Resin sticker added to Bordeaux mixture increases its toxic action and reduces the stand. The addition of lead arsenate or soaps does not increase its toxic action on the grafts but rather increases its adhesiveness and its fungicidal efficiency. The more dilute Bordeaux mixtures did not reduce the stand and proved nearly as beneficial in reducing crown gall as the stronger mixtures. The use of Bordeaux mixture at 8-8-50, with or without lead arsenate, reduced the percentage of crown gall about 66 per cent over the checks and nearly 50 per cent over the mean percentage of crown gall in all the checks in the variety Wealthy.

Second progress report on apple scab and its control in Wisconsin, G. W. KEITH (*Abs. in Phytopathology, 11 (1921), No. 1, pp. 43, 44*).—In connection with the control of apple scab, the author reports the discharge of ascospores of *Venturia inaequalis* at Madison, Wis., from April 22 to June 12, the heaviest discharge occurring between May 11 and May 24. At Sturgeon Bay the first discharge of ascospores was noted on May 20, and the greatest prevalence occurred between June 8 and June 17. Spraying experiments conducted with reference to the discharge of the ascospores gave satisfactory results, both where lime sulphur and Bordeaux mixture were applied.

Blossom blight of the peach, M. T. COOK (*Phytopathology, 11 (1921), No. 7, pp. 290-294, pl. 1; abs. in Phytopathology, 11 (1921), No. 1, p. 43*).—Blossom blight due to *Sclerotinia cucrea* is reported as having been exceptionally severe in New Jersey in 1919 and 1920. It was less severe on young than on old orchards, but apparently had no connection with mummied fruits. The fungus is believed to spread from cankers formed on the wood of the preceding year.

Investigations to determine the identity of a *Cronartium* on *Ribes* in California, E. BETHEL and G. B. POSEY (*Abs. in Phytopathology, 11 (1921), No. 1, p. 46*).—As a result of a study of the *Cronartium* occurring on native currants and gooseberries in California, it was found that it is associated with the pinon blister rust (*C. occidentale*). In the region where it occurs the attack of the *Peridermium* on pinon pines is reported to exceed in virulence that of any other *Peridermium*, but sugar pine and other white pines, growing in close association with both aecial and telial stages of the rust, were found free from the disease. The rust is believed to overwinter largely, if not entirely, in the form of uredinial blisters on leaves which survive through the winter, thus obviating the necessity of an alternate host.

Valsa poplar canker, A. H. W. POVAH (*Phytopathology, 11 (1921), No. 4, pp. 157-165, figs. 3; abs. in Phytopathology, 11 (1921), No. 1, p. 45*).—The poplar canker caused by *Cytospora chrysosperma*, which has hitherto been reported from the Southwest and Northwest, was found in 1920 attacking poplar trees near Syracuse, N. Y.

Notes on the *Peridermiums* of pines in Colorado and California, E. BETHEL (*Abs. in Phytopathology, 11 (1921), No. 1, p. 45*).—A summary is given of the author's observations and of culture work on western *Peridermiums*. New aecial hosts are recorded for *P. flamentosum*, *P. stalactiforme*, and *P. harknessii*. All of these rusts have the same telial hosts, which are various species of *Scrophulariaceae*. Studies of *Uredo coleosporioides* have led to the conclusion that it may represent the uredinial stage of any one, or all, of the

three above-mentioned Peridermiums. Notes are given on the distribution and life history of *P. cerebrum*, the Cronartium stage of which occurs on oaks in California.

Lightning injury in *Hevea brasiliensis*, C. D. LARUE (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 46).—A description is given of lightning injury of the Para rubber tree, usually a single small branch at the top showing the first injury, followed by the death of the branch, and later the destruction of the trunk. On account of the frequent presence of *Diplodia rapax* in dead tissues, this organism has been supposed to cause the death of the tree, but culture experiments showed that it was only of secondary importance.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The conservation of wild life of Canada, C. G. HEWITT (*New York: Charles Scribner's Sons*, 1921, pp. XX+344, pls. 27, figs. 16).—This work by the late Dominion entomologist, the preparation of which extended through the last four years of his life, deals with the subject under the following headings: The value of wild life to the nation, the extermination of wild life, the game animals of Canada, the buffalo or bison (its present, past, and future), the game birds and larger nongame birds of Canada, birds in relation to agriculture, the enemies of wild life and the control of predatory animals, the periodic fluctuations of our fur-bearing animals, reserves for game and wild life in Canada, the protection of game and wild life by the Dominion Government, a review of provincial game legislation, individual and community effort in the conservation of wild life, Government reserves for the protection of birds, the utilization by domestication of our larger native ruminating mammals, and the sale of game.

Wild life in the tree tops, C. W. R. KNIGHT (*London: Thornton Butterworth, Ltd.*, 1921, pp. 144, pls. 32).—This is an account of the author's observations and experiences while studying those birds and mammals whose habit it is to frequent the upper branches of trees.

Birds one should know, beneficial and mischievous, T. WOOD (*London: Gay & Hancock, Ltd.*, 1921, pp. XI+132, pls. 24, figs. 178).—This is a popular account of some 33 species, many of which are illustrated by colored plates.

A comparison of the food habits of British and American starlings, E. R. KALMBACH (*Auk*, 39 (1922), No. 2, pp. 189-195).—The data obtained from the examination of 2,157 stomachs of adult starlings collected in the centers of starling abundance in this country, mainly during 1916, are compared with the findings of W. E. Collinge in Great Britain in 1918. A report of investigations of the starling by the author and Gabrielson has been noted (*E. S. R.*, 44, p. 547).

[Report of the] division of entomology and economic zoology, W. A. RILEY ET AL. (*Minnesota Sta. Rpt.* 1921, pp. 55-60).—In work by W. C. Cook on cutworm baits, bran and molasses was very attractive to the larvae, and the addition of fruit essence did not add to the attraction.

Experiments with the chicken nematode (*Heterakis papillosa* Bloch) showed that this parasite does not pass a part of its early cycle in the lung of the host, as does *Ascaris*. None of the recommended disinfectants will render infected ground safe, since the eggs of this nematode will develop to the infective stage in a 1 to 1,000 solution of bichlorid of mercury or in a 1 per cent solution of sulphuric acid.

In the work by S. A. Graham on insects injurious to pulp wood, subcortical temperatures of 60° C. (140° F.) or more were observed on the upper side of logs exposed to the direct rays of the sun. Logs in deep shade are apparently

less subject to injury by the more serious wood destroyers than those in more open situations.

The results of studies by W. Moore on the toxicity of arsenicals for insects and their hosts are reported upon. In a study of the nutritional requirements of *Tribolium confusum* DuV. by R. N. Chapman it was found "that these insects have certain dietary limitations which may be measured by recording either the death rate or the time of metamorphosis. The death rate curve of beetles in a 'synthetic flour' is almost identical with that from wheat flour, but the metamorphosis curve shows a retardation of 10 days or more when compared with a culture in wheat flour."

Five years' observations (1914-1918) on the bionomics of southern Nigerian insects, chiefly directed to the investigation of Lycenid life histories and to the relation of Lycenidae, Diptera, and other insects to ants, C. O. FARQUHARSON, edited by E. B. POULSON (*Ent. Soc. London, Trans., pt. 3-4 (1921), pp. 319-531, pls. 11, figs. 6*).—This report of observations contains much data of value to the economic entomologist. Supplementary papers by different authors are presented in an appendix.

Report of the entomologist, J. C. HUTSON (*Ceylon Admin Rpts Sect. IV, Dept. Agr., 1920, pp. C 15-C 17*).—This report includes a brief account of the more important insects of the year and control work therewith.

Report of the proceedings of the fourth entomological meeting, held at Pusa February 7 to 12, 1921, edited by T. B. FLETCHER (*Ent. Meeting Pusa, Rpt. Proc., 1921, pp. XII+401, pls. 67*).—The papers presented at this meeting (*E. S. R.*, 45, p. 656) are as follows. Additions and Corrections to the List of Indian Crop Pests, by T. B. Fletcher (pp. 14-20); Additions and Corrections to the List of Crop Pests in South India, by E. Ballard (pp. 21-28); Short Notes on New and Known Insects from South India, by T. V. Ramakrishna Ayyar (pp. 29-40); *Oryza velox*, by Y. Ramachandra Rao (pp. 41, 42); First Entomological Records in Portuguese India, by F. de Mello and P. Correa Afonso (pp. 43-48); An Entomologist's Crop Pest Calendar for the Madras Presidency, by T. V. Ramakrishna Ayyar (pp. 49-55); Some Notes on Attempts to Produce Immunity from Insect Attack on Tea, by E. A. Andrews (pp. 56-59); Report of Campaign Against *Spodoptera mauritia* Boisdu (Noctuidae) in Malabar (pp. 60-69) and Results of Investigation of Bionomics of *Platyedra gossypiella* Saund. in South India, together with Some Notes on *Earias insulana* and *E. fabia* (pp. 70-83), both by E. Ballard; *Oryctes lactus*, the Dusky Cotton Bug, by C. S. Misra (pp. 84-92); Notes on Cotton Bollworms (*E. fabia* and *E. insulana*) (pp. 93-95), Notes on Cotton Woolly Mite (*Eriophyes gossypii*) (pp. 96, 97), and Notes on "Katra" (Hairy Caterpillars) and Their Controlling Measures (pp. 98-104) all by T. N. Jhaveri; Supplementary Observations on Borers in Sugar Cane, Rice, etc., by C. C. Ghosh (pp. 105-136); Note on Sugar-Cane Borers in the Central Provinces, by J. L. Khare (pp. 137-142); Juar Stem Borers (*Chilo simplex* and *Sesamia inferens*), by T. N. Jhaveri (pp. 143-147); Preliminary Note on Winter Spraying Against Mango Hopper (*Idiocerus* spp.), Vernacular Name Tela, by M. Afzal Husain and H. Singh Pruthi (pp. 148-152); Notes on *Natada naraya* Moore, by E. Ballard and Y. Ramachandra Rao (pp. 153-156); Note on a Braconid Parasite of *Agrotis ypsilon*, by H. L. Dutt (pp. 157-163); A Preliminary List of the Insect Pests of Mesopotamia, by Y. Ramachandra Rao (pp. 164-173); Some Observations on the Control of Field Rats in the Punjab, by M. A. Husain and H. Singh Pruthi (pp. 174-181); Recent Work in Forest Entomology, by C. F. C. Beeson (pp. 182, 183); A Note on the Effects of Mercurous Chlorid on Culicid Larvae, by S. K. Sen (pp. 184-191); Oviposition in Culicidae, by H. N. Sharma and S. K. Sen (pp. 192-198); A Preliminary Note on the Action of Acids, Salts and Alkalis

on the Development of Culicid Eggs and Larvae, by H. N. Sharma (pp. 199-204); The Distribution of Mosquitoes in Relation to the Zoogeographical Areas of the Indian Empire, by S. R. Christophers (pp. 205-215); A Preliminary Note on New Thoracic Appendages in Anopheline Larvae, by M. O. Tirunarayana Iyengar (pp. 216-218); Traps for Mosquitoes, by T. B. Fletcher (pp. 219-221); Surra and Biting Flies: A Review, by T. B. Fletcher and R. Senior-White (pp. 222-235); Further Notes on the Occurrence of Coleoptera in the Human Intestine, by R. Senior-White and S. K. Sen (pp. 236-239); Preliminary Observations on Lethal Temperatures for the Larvae of *Trogoderma khapra*, a Pest of Stored Wheat, by M. Afzal Huzain and H. Dass Bhasin (pp. 240-248); *Anatrachyntia falcateella* Stt. (*Pyroderces apodoctha* Meyr.) (pp. 249-252) and Determination of Emergence of Larvae from Examination of the Ovaries of Lac Insects (pp. 253-258), both by C. S. Misra; The Proportion of the Female Forms of *Papilio polytes* L. in Dehra Dun, United Provinces, and Bihar, by E. B. Poulton (pp. 259-269); Note on Oviposition of *Gynacantha bainbriggei* (Odonata), by T. B. Fletcher (pp. 270, 271); Note on the Life History of *Culicoides oxystoma*, with Some Remarks on the Early Stages of Ceratopogon, by P. G. Patel (pp. 272-278); Protective Movements and Range of Vision in Platypezid Flies, by F. M. Howlett (pp. 279-286); *Gracillaria soyella* Van Dev. and Its Parasite *Asympiesiella india* Gir., by G. R. Dutt (pp. 287-290); Life History Notes on *Stauropus alternus* Wlk., by P. Susainathan and C. V. Sundaram (pp. 291, 292); Notes on the Life History of Two Species of Celyphidae, by S. K. Sen (pp. 293-297); Preliminary Observations on the Oviposition and Life History of *Microbracon lefroyi*, A Braconid Parasite of *E. insulana*, by M. Afzal Huzain and U. Bahadur Mathur (pp. 298-311); Koenig's Paper on South Indian Termites (pp. 312-333) and Setting Without Boards (pp. 334, 335), both by T. B. Fletcher; A Check List of Coccidae of the Indian Region (pp. 336-362) and A List of Parasitic Hymenoptera of Economic Importance from South India (pp. 363-366), both by T. V. Ramakrishna Ayyar; Report of the Catalogue Committee (p. 367); The Practical Application of Insect Psychology, by F. M. Howlett (pp. 368-380); An Interesting Example of Gynandromorphism in *Megachile bicolor* Fb., by G. R. Dutt (p. 382); and Notes on the Imperial Entomological Conference, London, June, 1920, by C. F. C. Beeson (pp. 383-387).

Heat for control of cereal insects, W. H. GOODWIN (*Ohio Sta. Bul.* 354 (1922), pp. 3-18).—This account is based upon investigations of the subject by the author for several years at the station and during a single year with the Pennsylvania Department of Agriculture. Tests were made of the effect of varying degrees of heat and humidity on several insects and at the same time of the effect upon the viability of the principal grains. During the course of the investigation complete heating plants, assembled according to definite specifications, were installed in several mills under the author's direction. Access was also had to more than 30 mills which now have successful heating systems, and the records and recommendations presented are based upon the data gathered from these various sources.

It was found that many and probably most of our common insect pests succumb readily to a temperature of approximately 130° F., with practically no injury to the substances on which they feed. Some growing plants can be exposed to 120° for 10 to 15 minutes with little or no injury. Insects affecting various nuts and dried fruits are amenable to heat treatment.

"In practical experiments in flour mills, seed-storage rooms, and when treating weevil-infested beans in a small drying room that had been constructed for drying fruit, corn, and vegetables, the heat or high temperature

method was found to be safe, simple, readily provided, permanently effective, and not expensive, when first cost is distributed through the many years the equipment can be used. Weevil in chestnuts and acorns and the seeds of ash were killed when the seeds were raised to a temperature of 122 to 125°, holding that temperature for 2 to 3 hours after it was reached, but in this case the seeds were not tested to see if they would germinate successfully after treatment. It appears that this method must be of considerable value in treating newly threshed chestnuts, and that much of the injury by the nut weevils can be prevented without rendering the nuts unfit for food. . . . Wheat after being subjected to 150° for 2 hours germinated as well as untreated wheat from the same lots. Peas and beans were raised to a temperature of 140° for 20 minutes and were apparently uninjured, as they germinated well. Corn heated to a temperature of 140° for almost 2 days germinated almost as well as an untreated sample from the same lot." The possibility that damp seed might be injured by being raised too rapidly to such temperatures is mentioned.

In repeated tests with the different stages of some 20 different species of insects affecting stored grain and cereal products, it was found that a difference as great as 8 to 10° was required to effect the destruction of the different species. In no case were newly deposited eggs found that would hatch when heated to a temperature of 108 to 109° for a period of from 20 to 30 minutes, but eggs that had been deposited several days and were approaching the hatching point were not sufficiently affected by this temperature to prevent the hatching of all of them. However, the much higher temperature required for destroying the other stages will always insure the destruction of the eggs. Small larvae of *Trogoderma ornatum* lived through temperatures of 118.4 to 120.2° and in one case 122°.

It was found impossible to heat grain in ordinary bins without modifying the method and combining aeration with heat or high temperature. The grain can be thoroughly aerated by thrusting in perforated tubes and forcing air through them. Four formulas for the calculation of radiation surface are presented, by use of any one of which the amount of radiation surface required for a steam-heating plant designed for killing insects can be calculated for any mill. All four formulas may be used in calculating for the same mill, and the results checked against each other to secure accuracy.

Insect enemies of vegetable garden crops, S. C. VINAL, rev. by R. H. ALLEN (*Mass. Dept. Agr., Dept. Bul. 31* (1922), pp. 27).—This is a summary of information on the more important insect pests of garden and truck crops and means for their control.

Insects injurious to the mango in Florida and how to combat them, G. F. MOZNETTE (*U. S. Dept. Agr., Farmers' Bul. 1257* (1922), pp. 22, figs. 11).—Brief summarized accounts are given of the important insect enemies of the mango in Florida and means for their control. The pests thus considered are the blossom anomala (*Anomala undulata* Mels.), swarms of which sometimes visit the mango when it is in bloom and become a source of serious damage by attacking all portions of the blossom spike; the red spider (*Tetranychus yothersi* McG.), the attack of which causes the foliage to drop prematurely; the red-banded thrips, which attacks the lower surface of the foliage; the mango shield scale (*Coccus acuminatus* Sign.); the tessellated scale (*Eucalymnatus tessellatus* Sign.); the Florida red scale (*Chrysomphalus aonidium* L.); the mango scale (*Leucaspis indica* Marl.); and the Florida wax scale. Brief mention is also made of a number of foreign insect enemies of the mango which should be kept out of the United States.

Poisonous metals on sprayed fruits and vegetables, W. D. LYNCH, C. C. McDONNELL, J. K. HAYWOOD, A. L. QUAINANCE, and M. B. WAITE (*U. S. Dept. Agr. Bul. 1027 (1922)*, pp. 66).—This is a report of a cooperative study by the Bureaus of Entomology, Plant Industry, and Chemistry commenced in the spring of 1915. In conducting the study various fruit trees and vegetables were sprayed according to accepted formulas and also with excessive amounts of materials in order to determine how much of the metals may be present under adverse conditions. The results of previous investigations are first reported in connection with an appended bibliography of 134 titles. The investigations conducted included experiments on peaches, cherries, plums, apples, pears, grapes, cranberries, tomatoes, celery, and cucumbers. The spraying schedules and the details of the investigations are presented in large part in tabular form.

The investigations have shown that when sprayed in accordance with the schedules recommended by the Bureaus of Entomology and Plant Industry but little of the material remains on the fruits or vegetables at harvest time. When peeled, sprayed fruits and vegetables contain essentially the same amounts of arsenic, lead, and copper as the unsprayed products, indicating that practically all of the spray residues can be removed by peeling. Because of overspraying or late spraying comparatively large quantities of spray residue were found in some cases. This emphasizes the importance of spraying according to the schedules recommended.

Paradichlorobenzene, a soil fumigant, E. O. ESSIG (*Calif. Dept. Agr. Mo. Bul., 11 (1922)*, No. 1, pp. 28-30, fig. 1).—This is a discussion of the use of paradichlorobenzene as a control measure for the California peach tree borer (*Aegeria opalescens*). An average of 98 per cent kill was obtained. It appears to have also been used with success against the pear root aphid (*Eriosoma lanuginosa* Hart.) on 3- and 4-year-old pear trees in Contra Costa County. Examinations made in October, following its use in September and earlier in October, failed to show the presence of a single living aphid on the treated trees, though check trees were thoroughly infested.

The preservation of wood against termites, T. B. FLETCHER and C. C. GHOSH (*Agr. Research Inst., Pusa, Bul. 110 (1921)*, pp. 705-711).—Tests made of some 12 different preservatives advertised for use in India as protective to wood liable to attack by termites are reported upon. The treatment with hot creosote was the most effective, giving protection for more than 81 months, followed by cold creosote, which was effective for less than 28 months, carbolineum effective for less than 23, the Powell process less than 21, lead arsenate less than 16 months, etc.

Notes on the migration of *Melanoplus atlantis* Rtl. in northern North Dakota in 1920: Observations in Bottineau and Renville Counties, C. L. CORKINS (*Canad. Ent., 54 (1922)*, No. 1, pp. 1-4).—The author here presents data which show what an unexpected extensive migration from unorganized counties did to upset work where grasshopper control was effective. The habits of the lesser migratory locust (*M. atlantis*), as observed in this migration, were very unlike the usual habits of this species and could better be attributed to the presumably extinct Rocky Mountain migratory locust (*M. spretus* Uhl.). The details of observations on flight and the relation of weather conditions thereto are presented in tabular form.

Concerning the actual status of the destruction of the locust by *Coccobacillus acridiorum* of D'Herelle, R. KRAUS (*Rev. Inst. Bart. [Argentina], 2 (1921)*, No. 6, pp. 297-300).—The author states that he does not consider the efficacy of the biological method of control of D'Herelle to have been as yet demonstrated.

The chinch bug and its control, J. R. HORTON and A. F. SATTERTHWAIT (*U. S. Dept. Agr., Farmers' Bul. 1223* (1922), pp. 35, figs. 15).—This is a summary of information on the present status of knowledge of this pest and means for its control.

A host plant list of aphids in the vicinity of the University of Florida, A. C. MASON (*Fla. Ent.*, 5 (1921), No. 2, pp. 21-25).—Some 30 species of Aphididae are listed.

Control of the bagworm, C. E. SANBORN (*Okl. Agr. Col. Ext. Circ. 126* (1921), pp. 4, figs. 4).—This is a popular account of the bagworm and means of control.

Bagging the bagworm (*Missouri Bot. Gard. Bul.*, 9 (1921), No. 3, pp. 37-41).—Control measures for the bagworm are briefly considered.

The present situation with regard to the control of the pink bollworm in Egypt, G. STOREY (*Egypt Min Agr., Tech. and Sci. Serv. Bul. 16* (1921), pp. 16).—This is a summary of the present status of the pink bollworm problem in Egypt.

Arsenical spray residue on harvested fruit in relation to the control of codling moth on pears, A. J. ACKERMAN (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 1, pp. 12-28, figs. 5).—Investigations by the U. S. D. A. Bureau of Entomology show that the arsenical spray residues found on pears shipped East during the past few years can be eliminated by thorough work in the early sprays, thus making very late applications unnecessary. The codling moth can be controlled with three or at least four liquid sprays of arsenate of lead at the recommended strengths in the majority of pear orchards. Dusting can be recommended as an efficient method of controlling the codling moth.

The prevention of malaria in the Federated Malay States: A record of twenty years' progress, M. WATSON ET AL. (*London: John Murray, 1921, 2. ed., rev. and enl.*, pp. XXVII+381, pls. 50, figs. 48).—Control work with the *Anopheles* mosquitoes through drainage, oiling, etc., is considered at length.

Fecundation and longevity of the house fly, E. ROUBAUD (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 22, pp. 1126-1128).—A brief discussion of the subject.

Sheep-maggot flies, V. W. W. FROGGATT (*N. S. Wales Dept. Agr., Farmers' Bul. 144* (1922), pp. 32, figs. 10).—This publication, in continuation of earlier accounts (*E. S. R.*, 41, p. 86), presents recommendations as to methods of control as follows: (1) By the destruction of breeding grounds, (2) by trapping, (3) by spraying, dipping, crutching, dressing, and jetting, (4) by the use of parasites, and (5) by the protection of the natural enemies of the fly. Two appendixes consist, respectively, of a report of the work carried out in the Liverpool Plains District at the Government Sheep-Fly Experiment Station, Warrah, 1920-21, and an account of further observations on sheep-maggot flies and their parasites.

Controlling cabbage root maggots, H. J. EVANS (*Amer. Agr.*, 109 (1922), No. 17, p. 311, fig. 1).—Through the use of corrosive sublimate, applied May 8 at the rate of 1 oz. of the powder to 10 gal. of water, 98 per cent of the plants were saved on one farm in Nassau County, N. Y., and 95 per cent on another farm in the same locality, whereas 69 and 74 per cent of the plants, respectively, were destroyed on untreated parts of the fields. Very poor results were obtained, however, where the solution was applied after May 15. Where the cabbage seed beds remain unscreened, the cabbage root maggot may be almost entirely controlled by applying this solution when the plants are 2.5 or 3 in. high, or about the first week in May. It was found that one application was not sufficient, and that four applications at seven-day intervals are not too many.

The cabbage maggot, L. CAESAR (*Ontario Dept. Agr. Circ. 40 (1922), pp. 4, figs. 5*).—In discussing methods of control, the author recommends the use of corrosive sublimate 1 oz. to 10 gal. of water for transplanted cabbage and cauliflower and 1 oz. to 8 or 10 gal. of water for radishes and seed beds of late cabbage and cauliflower. Two applications to the soil about each plant are considered sufficient, though three are preferred by some.

A summary of the food habits of North American Coleoptera, H. B. WEISS (*Amer. Nat., 56 (1922), No. 643, pp. 159-165, fig. 1*).—In summarizing the food habits of North American Coleoptera, the author finds about 26 per cent of the species to be phytophagous, 44 per cent to be saprophagous for the most part, 27 per cent to be predacious, and 3 per cent to be obscure.

Potato insect pest control, T. M. MCCALL (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 112, 113*).—Comparative tests made of various insecticides recommended for control of potato beetles have led to the following conclusions:

"Two and one-half lbs. of lead arsenate or 3 lbs. calcium arsenate was required to equal in effectiveness 1 lb. of Paris green in the liquid spray test. Calcium arsenate had to be used in double amounts to equal Paris green as a dust spray. Lead arsenate and calcium arsenate are slower acting poisons than Paris green. Lead arsenate is apparently more effective as a liquid than as a dust spray. Homemade lead arsenate and calcium arsenate have proved effective against the potato beetle. Homemade arsenate of soda although caustic in nature, in one year gave promise of being adaptable as a potato spray. Paris green proves more effective as a liquid spray when 1 qt. of lime paste is used for every pound of poison. At least 1 lb. of Paris green must be applied per acre as a dust spray irrespective of the amount of lime used as filler. Ten pounds of lime to 1 lb. of Paris green is a good combination. Caution must be used to prevent poisoning by the inhaling of the dust sprays. Arsenical poisons to be most effective must be applied when the beetles first hatch, which means that at least two sprayings must be made for beetles in ordinary seasons. Insecticides in combination with Bordeaux mixture should be applied three times during the season, effectively to control insects and diseases."

A book about the bee, H. MACE (*New York: E. P. Dutton & Co., pp. X+138, pls. 16*).—This is a popular account.

Bees for pleasure and profit, G. G. SAMSON (*London: Crosby Lockwood & Son, 1921, 5. ed., rev. and enl., pp. XII+122, figs. 55*).—This is a concise handbook on apiculture.

[Report of the] division of bee culture, F. JAGER and G. C. MATTHEWS (*Minnesota Sta. Rpt. 1921, pp. 51-53*).—In reporting upon the work of the year it is stated that queen raising, hitherto considered an exclusive southern industry, has been definitely proved to be possible in Minnesota. About 350 nuclei were made from 40 colonies yielding 775 queens for shipment to beekeepers, all of which were daughters of a high grade Italian queen purchased for the purpose. Brief reference is made to the methods used in the controlled mating of queen bees.

Report of the Dominion apiarist, F. W. L. SLADEN (*Canada Expt. Farms, Bee Div. Interim Rpt., 1921, pp. 12, figs. 2*).—This report, by the late author, for the year ended March 31, 1921, includes an account of the prevention of swarming by management and by breeding, including work conducted on Duck Island; size of hives; wintering of two queens in a hive; and wintering at Ottawa in 1919-20 and 1920-21, both out- and indoors. The Duck Island experiments (*E. S. R., 45, p. 859*) were repeated on a larger scale in 1920, and a considerable number of perfect matings were obtained.

Parasites of olive scale (*Lecanium oleae*), W. W. FROGGATT (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 1, p. 56).—This paper refers briefly to the rearing by L. Gallard of the humpback, an introduced chalcid (*Scutellista cyanea*), a small black species (*Coccophagus orientalis*), two other species of *Coccophagus*, and the golden chalcid (*Aphycus lounsburyi*).

Fauna Ibérica: Hymenoptera; family Encyrtidae, R. G. MERCET (*Fauna Ibérica: Himenópteros; Fam. Encirtidos. Madrid: Inst. Nav. Cien.*, 1921, pp. XI+752, figs. 292).—This synopsis of an important family of parasites includes descriptions of many new species. Twenty-eight genera are erected.

FOODS—HUMAN NUTRITION.

An introduction to biophysics, D. BURNS (*London: J. & A. Churchill*, 1921, pp. XIII+435, figs. 85).—The aim of this volume is to present physiological phenomena from a purely physical standpoint. The first section on energetics deals with the laws of energy and with the principles governing its storage and liberation in the plant and animal organism. Section II on cellular mechanics consists of chapters on ions, the workmen of the cell; colloids, the reservoirs of energy; enzymes, the tools of the cell; membranes, the house of the cell; radio activity, the atom in dissolution; and the cell as a whole. Section III on cell communities deals with the muscle, manufacturing, eliminating, connective tissue, and nerve cells, the latter being classed as the intelligence service of the body of which the general receptors and the ear and eye are outposts. In Section IV on transport, the blood is considered as the inland transport service, and the external respiration, alimentary canal, locomotion, and voice as the overseas transport. The fifth section deals with the mechanics of the animal as a whole, including preservation of neutrality, the regulation of temperature, tropisms, adaptation, growth, development, death and dissolution, and efficiency. A number of experiments illustrating different parts of the text are given in conclusion.

The opening and closing chapters of the theoretical part of the book are contributed, respectively, by D. N. Paton and E. P. Cathcart, and the chapter on the eye by W. F. Shanks.

The newer knowledge of nutrition, E. V. MCCOLLUM (*New York: Macmillan Co.*, 1922, 2. ed., rewritten, pp. AVIII+449, pls. 20, figs. 14).—The first edition of this volume (*E. S. R.*, 40, p. 554) has been entirely rewritten and considerably enlarged. Particular attention is paid to the study of the dietary habits of peoples in different parts of the world in relation to the present views of nutrition as based upon animal experimentation.

The foods of the next century, C. H. LAWALL (*Amer. Jour. Pharm.*, 94 (1922), No. 5, pp. 309-329).—In this popular lecture, delivered at the Philadelphia College of Pharmacy and Science, the author traces briefly the changes in food habits from the remote past to the present time, and suggests the changes to be expected in the future through further improvements in transportation, the development of new varieties of present foods, the increase in crop yields insuring more abundant and cheaper foods, the development of better methods of food conservation, a wider distribution of foods of other countries, and the education of the consumer to overcome bad food habits.

The optimum diet, J. O. HALVERSON (*N. C. Agr. Col. Ext. Circ.* 125 (1922), pp. 8, figs. 6).—A popular discussion emphasizing the importance in the diet of vegetables, fruits, and milk.

The food campaign of 1916-1918, ERNLE (*Jour. Roy. Agr. Soc. England*, 82 (1921), pp. 1-48).—This is a concise history of the war organization of the farming industry of England in 1916 for the purpose of increasing food pro-

duction. The principles of the policy adopted and the machinery of its operation are outlined briefly, and the successes and failures of the system are reviewed.

Sitting-height and stem-length in private school boys, H. GRAY (*Amer. Jour. Diseases Children*, 23 (1922), No. 5, pp. 406-418, figs. 4).—The data presented in this paper supplement the author's ideal standards of measurements for private school boys by records of the sitting-height and stem-length of the same 114 boys previously used as subjects (E. S. R., 47, p. 166).

The sitting-height averaged $\frac{1}{2}$ in. greater than the stem-length, but was not constantly parallel to it. The stem-length was found easier to measure accurately. The absolute values both for stem-length and sitting-height were higher than any reported in the literature, while the proportional sitting-heights or sitting-heights related to stature were considerably less than those in the literature. This is thought to indicate that well-developed children have longer legs for their height than children retarded in growth.

The energy requirements of girls from 12 to 17 years of age, F. G. BENEDICT and M. F. HENDRY (*Boston Med. and Surg. Jour.*, 184 (1921), Nos. 9, pp. 217-222; 10, pp. 257-262, fig. 1; 11, pp. 282-286; 12, pp. 297-306, figs. 4; 13, pp. 329-334, figs. 2).—This study of the energy requirements of girls from 12 to 17 years of age was conducted on girl scouts who were studied in groups of 12 in the chamber calorimeter used in previous investigations at this laboratory (E. S. R., 42, p. 62). The carbon dioxide production for each group was measured for every half hour or hour period throughout the night, and the respiratory quotients calculated from these measurements. Determinations were also made of the pulse rate and the insensible perspiration. The data obtained are summarized as follows:

The respiratory quotients of groups of 12 girls each about 7 or 8 hours after a light meal were 0.81, 0.81, 0.78, and 0.79.

The caloric requirement during 10 hours of rest in bed averaged 55 calories per individual per hour. The average 24-hour basal heat production was 1,250 calories per individual, irrespective of age. The heat production per kilogram of body weight per 24 hours decreased regularly from 29.9 calories at 12 years and 2 months to 21.7 at 17 years. Calculated per square meter of body surface per 24 hours, the heat production decreased, although not so regularly, from 928 calories at 14 years to 745 at 16 years. The curves representing these data blend with those based upon the measurement of the large number of normal girls from birth to 12 years of age. It is concluded that "the metabolism of groups of young girls can be predicted from the general curve indicating the heat production per kilogram of body weight referred to age to within an average error of ± 31 per cent. The prediction for the heat production per unit of body weight is somewhat better than per unit of surface area."

The average minimum resting pulse rate per minute of the different subjects just before rising in the morning was found to be 81 at 12 years of age, 77 at 13 and 14 years, 83 at 15, 71 at 16, and 74 at 17 years of age.

The insensible perspiration per kilogram of body weight per hour was 0.72 gm. at 13 years, 0.71 at 14, and 0.77 gm. at 15 years.

Continuation and extension of work on vegetable proteins, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Wash. Yearbook* 20 (1921), pp. 432-441).—The investigations summarized in this annual report, in continuation of the work of the previous year (E. S. R., 45, p. 108), have in general been noted from other sources.

A brief report is given of the study of the effect of the maternal diets during pregnancy upon the subsequent growth of the offspring. Pregnant rats were

placed upon diets practically devoid of vitamin A and continued on this diet through the suckling period. In several cases the families of young grew slowly and developed ophthalmia within a few weeks, while in other cases the young grew fairly well. In all cases the mother appeared to be less affected than the young by the deficient diet.

Renewed evidence has been obtained of the richness of cod liver oil in vitamin A. In several cases 14 mg. daily has proved sufficient to cure ophthalmia and promote renewal of growth in young rats on a diet deficient in vitamin A. On fractionation of the oil by the method previously used for butter (E. S. R., 30, p. 560), vitamin A appeared to be concentrated in the more soluble portion of the oil.

An extensive series of feeding trials to determine the requirement of rats for vitamin B in the form of dried brewery yeast tablets administered apart from the rest of the ration has shown that 200 mg. daily is sufficient at all ages for growth or maintenance. With 100 mg. per day growth takes place at a normal rate until the animals have attained about three-fourths the usual size, when growth and increase in weight cease. Twenty-five mg. appears to suffice for maintenance only after a few weeks of initial growth. Dried strawberries, lettuce, and asparagus have been found to contain less vitamin B than dried brewery yeast, as at least 0.4 gm. of these materials is required to produce the same effect obtained with one-half or less of this amount of dried yeast.

Dried whole milk powder has been found to furnish sufficient vitamin A and B to enable 70 gm. rats to grow to full size on a diet furnishing only corn starch and lard in addition to the whole milk powder.

The effect of edestin on mammary secretion, G. A. HARTWELL (*Lancet* [London], 1922, 1, No. 7, pp. 323, 324, figs. 3) —Continuing the studies on mammary secretion previously noted (E. S. R., 47, p. 62), the author has determined the effect on suckling rats of adding commercial edestin to various diets given the mother rats. The addition of 1 gm. daily to a diet of white bread soaked in whole milk was without effect on the growth curves of the litters. Both commercial casein and edestin in small amounts, however, proved satisfactory in supplementing a deficient basal diet of white bread soaked in water in which a little marmite was dissolved. When edestin was present in large amounts in the mother's diet (46 per cent of the dry weight of the food) the young died, as in a former experiment with other proteins (E. S. R., 45, p. 863).

Amino acids in nutrition.—IV, A modified biological method of studying amino acid deficiencies in proteins.—Cystin as a growth-limiting factor in the proteins of the Georgia velvet bean (*Stizolobium deeringianum*), B. STUE (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 103–111, figs. 7) —Continuing the series of studies on amino acids in nutrition (E. S. R., 45, p. 864), evidence is presented that cystin is one of the growth-limiting factors of the Georgia velvet bean, a bibliographical analysis of which has been previously noted (E. S. R., 46, p. 108). This conclusion is drawn as the result of the use of a modified procedure for studying the amino acid deficiencies in proteins, consisting of the addition of so-called deficient proteins to the protein in question before the addition of the amino acid to be tested. It was found that the addition of cystin and arachin, prolin, cystin, and tryptophan to the Georgia velvet bean, fed at a 40 per cent level, did not supplement the protein to the extent of causing growth in the experimental rats, but that there was a slow response to cystin when the bean ration was supplemented with gliadin or zein, and a marked and continuous response to cystin when the beans were supplemented with gelatin.

A reply to Fulmer, Nelson, and Sherwood concerning medium F. W. H. EDDY, H. L. HEFT, and H. C. STEVENSON (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 83-85).—In reply to the paper previously noted (E. S. R., 47, p. 266), the authors report data in which the work of Fulmer and Nelson was repeated to the extent of using alcohol extracts of varying concentrations and controlling the temperature at exactly 30° C. These data show stimulation of the synthetic medium with the alcohol extract but to a less extent than with the water extract. It is noted that the results which showed the most stimulation were obtained with concentrations of the alfalfa extract much greater than those used by Fulmer. This and the difference in method of measuring are thought to account for the difference in results.

The phytin content of foods. E. ARBENZ (*Mitt. Lebensmitl. Untersuch. u. Hyg., Schweiz. Gesundheitsamt.*, 13 (1922), No. 1-2, pp. 45-52).—Various methods of determining phytin are reviewed from the literature, and determinations of the phytin content of cereals, etc., by the method of Heubner and Stadler (E. S. R., 34, p. 10) are reported, with the following results in terms of percentage of the fresh substance: Rice bran, 3.801 per cent, rice flour 0.192, wheat bran 4.641, whole wheat 0.498, wheat flour 0.184, corn meal 0.764, lentils 0.292, peas 0.498, oatmeal 0.460, and cocon 2.110 per cent. No phytin was found in carrots, turnips, cauliflower, Brussels sprouts, cabbage, spinach, asparagus, apples, pears, and figs.

Studies in carbohydrate metabolism.—III, A study of urinary sugar excretion in 26 individuals. I. NEUWIRTH (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 11-16).—The previous study in this series (E. S. R., 39, p. 874), has been extended to a similar investigation of the urinary sugar excretion in a number of normal individuals, using the method of sugar determination recently developed by Benedict and Osterberg (E. S. R., 46, p. 417). The data obtained are presented in two tables, in the first of which are given the findings for 22 normal persons and in the second for 4 subjects showing slight abnormalities. The maximum, minimum, and average figures in the first table include the following: Volume of urine in 24 hours 3,100, 415, and 1,183.4 cc., respectively; total sugar 1,383.2, 614.2, and 941.2 mg.; fermentable reducing substances 487.6, 134.3, and 333.7 mg.; and nonfermentable reducing substances 1,024.1, 370, and 607.5 mg.

Of the subjects reported in the second table, 1 gave normal figures and 1 in 2 of the 4 days recorded higher figures for total sugar and in all 4 days higher for fermentable sugars than those of the first table. The remaining subject, whose urine frequently gave a qualitative test for sugar, gave high figures for total and fermentable, but lower for nonfermentable, sugar. In all cases the results obtained before and after fermentation indicated that normal urine contains a reducing fermentable substance.

Studies in the fat metabolism of the timothy grass bacillus. M. STEPHENSON and M. D. WHETHAM (*Roy. Soc. [London], Proc., Ser. B*, 93 (1922), No. B 652, pp. 262-280, figs. 7).—In an effort to throw light on the nature of fat metabolism, the growth of the timothy grass bacillus on a medium consisting of inorganic salts (including ammonia as the sole source of nitrogen), glucose, and sodium acetate was followed in detail by measurements of the protein nitrogen and fat synthesized by the organism, and the disappearance of the glucose and acetate from the medium. The fat was determined as a phosphatid and nonphosphatid fraction.

It was found that the growth of the bacillus as thus measured reaches a maximum at the point at which glucose and acetate disappear from the medium, and that from this point onward the bacillus utilizes its own lipid material, which rapidly decreases.

The nonphosphatid material was found to decrease at first more rapidly than the phosphatid. "This suggests that the 'fat' fraction represents a form of stored food material which is drawn upon when external sources of carbonaceous food material fail, while the 'phosphatid' fraction, which decreases less rapidly, is probably partially composed of some unit essential to the chemical structure of the cell."

No intermediate decomposition products of glucose could be identified. Some indication of the nature of these intermediate products was afforded by a study of the growth of the organism on lactic and acetic acid. The growth on lactic acid (as sodium lactate) was similar to that on glucose, while the growth on acetic acid (as sodium acetate) was negligible. On both acetate and lactate the growth was such as to show that the presence of lactic acid enables the organism to utilize the acetic acid, as did glucose likewise. The acetic acid utilized in the presence of lactic acid or glucose appeared to increase the proportion of lipoid material formed rather than the general growth of the organism. Growth on propionic acid and on butyric acid was similar to that on lactic acid; that is, the organism was able to synthesize both nitrogenous and fatty materials without the addition of other carbon compounds.

The chlorin content of cows' and goats' milk and formulas commonly used in infant feeding. W. R. Sisson and W. DENIS (*Amer. Jour. Diseases Children*, 23 (1922), No. 5, pp. 431-437) --Using the technique employed in their previous study of the chlorin content of human milk (*E. S. R.*, 45, p. 764), the authors have made a similar study of the chlorin content of cow's milk, goat's milk, and various formulas made from cow's milk that are used in infant feeding.

The average chlorin content of 25 specimens of milk obtained from a dairy of Holstein cattle was 108.9 mg. per 100 cc. and of 12 Jersey cows from another dairy was 170 mg. Marked variations occurred in the content of chlorin in different samples of milk from the first herd, but that of the second was quite constant. The variations had no relation to the salt intake, the stage of lactation, or the time of milking. The principal factor influencing the concentration of chlorin in the milk was apparently the total volume of milk secreted, the larger the volume the lower being the content of chlorin. This also proved to be true of goat's milk, the chlorin content of which varied from 124 to 189 mg. per 100 cc.

The salt content of various milk formulas varied greatly and was in general much in excess of that found in human milk. Formulas made of whole milk and of cream and skimmed milk had a chlorin content approaching that of human milk, while the chlorin content of formulas made from whey generally exceeded that of human milk by over 200 per cent. Protein milk also varied considerably in its chlorin content.

In discussing these results, the authors advance the opinion that, in general, infants on cow's milk formulas receive excessive amounts of salt and that this may account for various nutritional disturbances.

The reaction of saliva and its possible influence on dental caries. J.-V. LAFARGA (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 7, pp. 412-414).--Determinations of the pH value and buffer action of saliva under various conditions are reported briefly.

Mixed saliva was found to vary in H-ion concentration from pH=6.8 to pH=7. The pH value varied from time to time with the same subject, being generally more acid in the morning and more alkaline after eating. Saliva was found to have a very considerable buffer action. Organic acids in different concentrations increased considerably by quantity, hydrogen-ion con-

centration, and the buffer action. Alkalis had less effect, substances having an agreeable or insipid taste had no effect, and very sweet or bitter substances increased considerably the amount of saliva, but did not change its pH value or buffer action.

To determine whether the H-ion concentration of the saliva has any influence on dental decalcification, teeth were placed for several hours in solutions of pH values of from 2 to 8. Independently of the composition of the liquid, the teeth became decalcified at pH values of 7 and below. This is thought to indicate that under ordinary conditions saliva has no decalcifying action, since it is a liquid which is practically neutral and has a marked buffer action.

The relation of photosynthesis to the production of vitamin A in plants, J. W. WILSON (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 455-459, figs. 3).—A limited number of experiments are reported in which etiolated wheat sprouts proved as effective as green sprouts of the same age as the sole source of vitamin A in feeding experiments with rats when the dried sprouts constituted 5 per cent of the ration. Since this proportion of sprouts represents not more than 20 gm. of whole wheat seed, and it has been shown by McCollum and Davis that even 64 per cent of wheat in the diet does not furnish sufficient vitamin A, it is concluded that vitamin A is produced in the growing plant independently of photosynthesis. The apparently contradictory results of Coward and Drummond (*E. S. R.*, 46, p. 356) are attributed to the use of an insufficient amount of etiolated sprouts in their study.

B vitamin and pneumococcal infection, G. M. FINDLAY (*Lancet* [London], 1922, 1, No. 14, pp. 714, 715).—The suggestion is made that the decreased resistance to infection resulting from a diet deficient in vitamin B may be due in large part to the lowering of body temperature resulting from this deficiency. To test this hypothesis, four pigeons were placed on a diet of polished rice until their temperature was reduced to between 103° and 104° F. after from 21 to 26 days. They were then inoculated intraperitoneally with agar cultures of pneumococcus, and 64 control pigeons were similarly inoculated.

The control pigeons remained well, while those on the polished rice diet died in from 9 to 36 hours after the inoculation without showing any symptoms of paralysis. On autopsy the pneumococcus was isolated in all four cases from the abdominal cavity and heart's blood, while the same organs of two of the control pigeons killed 36 hours after the injection were sterile. It is stated that further experiments are being conducted on the resistance of pigeons on deficient diet to other species of bacteria.

Experimental studies with proprietary vitamin products, J. H. HESS, J. J. MOORE, and J. K. CALVIN (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 19, pp. 1441-1445, figs. 7).—Two well-known commercial vitamin preparations, said to contain vitamins A, B, and C, were tested for vitamin C by the usual protective feeding experiments with guinea pigs, and for vitamin B by curative and preventive experiments with pigeons.

Contrary to the claims of the manufacturers, these products did not protect guinea pigs from scurvy in doses twice the amount recommended for infants. The pigeons fed twice the amount of this preparation recommended as the proper dose for infants developed polyneuritis, although less rapidly than the control birds. A second commercial yeast preparation prevented and cured polyneuritis, although in the experimental work reported the equivalent of three yeast cakes was administered daily. A third product, now in the process of experimental preparation, which contains dried orange juice and desiccated pig's liver was tested for vitamins B and C and proved to be without value.

The authors conclude that "the claims that one or all of the known vitamins can be prepared for dispensing in a concentrated form which will not be affected by drying, aging, and oxidation are, in the light of our experimental work, open to great question. It is becoming more firmly fixed in the minds of leading investigators that, except to meet specific indications, as in times of famine and certain economic upheavals, such as in war, the best method of obtaining sufficient vitamins is through a proper selection of foods. Vitamins should be obtained from the dairy, the grocery, and the market, not from the drug store."

Studies in deficiency disease, R. McCARRISON (*London: Henry Frowde and Hodder & Stoughton, 1921, pp. XVI+270, figs. 82*).—This volume is based on the author's investigations, which have been previously reported in a series of papers under the general heading of the pathogenesis of deficiency disease (*E. S. R.*, 43, p. 664).

In the first part the objects and scope of the investigation are outlined, and a brief summary from the literature is given of the present knowledge of vitamins. The second part deals with the various factors which influence the onset of deficiency disease and the symptomatology of the disease, and the third with the morbid anatomical changes resulting from food deficiency. In the fourth and final part are discussed some of the practical applications of laboratory results to the prevention and cure of disease, including chronic gastro intestinal disorders, pellagra, and beriberi, and to the general selection of food.

The water content of the tissues in experimental beriberi, D. J. KRAUSE (*Amer. Jour. Physiol.*, 60 (1922), No. 2, pp. 234-243).—A comparison of the water content of various tissues of chickens, pigeons, rats, and guinea pigs suffering from lack of vitamin B with corresponding tissues of normal controls is reported with the following results:

There was no definite increase in the water content in the organs of polyneuritic chickens, but with the possible exception of the skin, there was an increased water content in the heart, lungs, skin, muscles, and kidneys in polyneuritic pigeons. In one guinea pig, suffering from lack of vitamin B, no increase in the water content of the organs studied was observed, while in rats there was an increase in some cases and not in others. In scorbutic guinea pigs, increased water content was not detected in analyses of the separate organs, but when the animals were dried whole such a tendency was noted.

Observations on cod liver oil and rickets, T. F. ZUCKER, A. M. PAPPENHEIMER, and M. BARNETT (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 167-169).—Attempts to isolate the antirachitic substance in cod liver oil are reported briefly. The crude bases were first isolated from the oil and found to be inactive. The oil was next hydrolyzed with sodium hydroxid, and the fatty acids were separated. These proved to be inactive and the unsaponifiable substance active. When the latter was dissolved in alcohol and the cholesterol removed by crystallization, the remaining substance had strong curative properties. There was finally obtained in this way a fraction which, on being diluted with 90 parts of inactive cottonseed oil, had curative properties slightly stronger than the original cod liver oil. That this material also contained vitamin A was shown by its ability to cure ophthalmia.

Spontaneous cure of rickets in rats, A. F. HESS, L. J. UNGER, and A. M. PAPPENHEIMER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 5, pp. 236-238).—Evidence is given of the spontaneous healing of rickets in rats on a diet furnishing an inadequate amount of phosphorus. Four rats on the rickets-producing diet described by Sherman and Pappenheimer (*E. S. R.*, 45, p. 767)

plus 25 mg. phosphorus in the form of secondary potassium phosphate developed rickets as indicated by X-ray after 32 days. After 48 days, during which period the rats made a total gain of 92 gm., the radiographs showed healing, and after 74 days the lesions appeared to be healed. No evidences of rickets were found on autopsy.

"The explanation suggested for this spontaneous healing is that, with a practically stationary weight over a long period, the phosphorus requirement for the building up of new tissue is greatly reduced. The small addition of phosphorus under such circumstances to the standard rickets-producing diet suffices to enable the bone to recalcify."

Studies of the metabolism of diabetes, R. M. WILDER, W. M. BOOTHBY, and C. BEILES (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 311-357, fig. 1).—This is a detailed report of the complete metabolism of a patient with severe diabetes for a period of 74 days during which the basal respiratory quotients averaged 0.693, the highest quotient being 0.74 and the lowest 0.65.

The ingestion of food was found to cause a depression of the respiratory quotient which was most marked after large amounts of protein. The basal metabolic level was materially affected by the previous diet. When the patient was decidedly undernourished, the metabolism was as much as 32 per cent below the Du Bois normal standards. The ingestion of food furnishing 1 gm. of protein for each kilogram of body weight, with sufficient fat and carbohydrate to exceed the daily maintenance requirement, raised the basal metabolic level. The level was still further raised by a larger amount of protein, but isocaloric amounts of other foods did not produce the same effect. It is thought that a basal metabolic rate equal to or higher than the Du Bois normal should be taken as a warning that the available food of the diet is excessively rich in protein, or that the patient is in a critical state of starvation and calling on his body protein to meet energy requirements.

The sugar tolerance of the diabetic patient was lowered by high caloric diets, and more markedly lowered by protein than by isocaloric amounts of fat. This is thought to be due to some specific action of the protein interfering with the mechanism of sugar utilization. In all the experiments the glucose tolerance varied inversely with the basal metabolic level, thus indicating a definite relationship between the two.

Outbreak of botulism at Cambridge, Idaho, R. T. WHITEMAN and E. A. WILKINSON (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 17, pp. 1278, 1279).—A brief report is given of an outbreak of botulism involving eight cases, six with fatal outcome. The source of toxin was evidently home-canned beet and turnip top greens, which were merely tasted by the survivors and eaten freely by the others. The greens were said to have a peculiar and musty smell and an unpleasant taste. No specimen of the suspected food could be obtained. Of seven cans prepared at the same time five showed signs of spoilage, although later findings were negative for *Bacillus botulinus*.

Eczema in breast-fed infants as a result of sensitization to foods in the mother's dietary, W. R. SHANNON (*Amer. Jour. Diseases Children*, 23 (1922), No. 5, pp. 392-405).—Eight cases of eczema in breast-fed infants are reported in detail. In all these cases cutaneous tests with proteins occurring in the diet of the mother have shown the infants to be sensitive to several of these proteins. Removal of the offending foods or limiting the amounts eaten has in all cases resulted in marked improvement in the urticaria, while a return of the trouble has almost invariably come through failure of the mother to continue the dietary restriction.

"As general prophylactic measures it is recommended that all mothers be cautioned to eat a large variety of foods and a small quantity of any individual article of diet, that eggs be restricted rather than forced in the diet of the mother, and that all cases of eczema be studied early and offending foods eliminated before sensitization becomes so widespread as to make proper limitation of diet impossible."

Observations on the conception that sprue is a mycosis superimposed upon a state of deficiency in certain essential food elements, B. K. ASHFORD (*Amer. Jour. Trop. Med.*, 2 (1922), No. 2, pp. 139-150).—This discussion of the etiology of sprue is based on observations on over 1,000 cases of typical sprue in Porto Rico from 1908 to 1921.

In the author's opinion, sprue is a specific infection by *Monilia pilosis* just as thrush is now recognized to be due to *Oidium* or *M. albicans*. The predisposing cause, as determined by the food habits of those suffering from the disease and the results of dietetic treatment, is considered to be a deficiency in certain food constituents, principally proteins, vitamin B, and mineral concentrates, and an excess of carbohydrates. The latter is considered of special significance as a predisposing factor in furnishing an acid medium in the intestines for the enrichment of *M. pilosis*. The unbalanced dietary of the agricultural laborer of Porto Rico is attributed to the disappearance of a large part of the native fruits and vegetables to make more room for sugar cane and to the increasing tendency to subsist largely on rice. The dietary treatment of the disease, which has given encouraging results, consists in the elimination from the diet of all sugar, cereals, beans, and potatoes, the liberal use of milk, eggs, fruit, and other vegetables, and the administration of pancreatin after each meal.

ANIMAL PRODUCTION.

Hydrolysis of straw, S. WEISER and A. ZAITSCHEK (*Landw. Vers. Sta.*, 97 (1920), No. 1-2, pp. 57-92; *abs. in Zentrbl. Gesam. Landw.*, 2 (1921), No. 10, pp. 372-376).—This is the report of a series of experiments carried on to determine the relation of the digestibility of hydrolyzed straw to the amount of soda used in treating it.

The first experiments reported were with two full-grown wethers in a series of 8 tests. Wether No. 1 developed a case of intestinal catarrh so that the results of the experiment with wether No. 2 are thought to be more reliable. In periods 1 and 6 a ration of hay alone was fed, whereas in periods 2 and 3 hydrolyzed straw replaced a part of the hay. This straw was chopped and cooked for 4 hours under 4 atmospheres pressure with a solution of 4.5 kg. and 1.7 kg., respectively, of caustic soda and 200 liters of water per 100 kg. of straw. The caustic soda was 86.2 per cent pure sodium hydroxid. During periods 4 and 5 untreated straw was used in place of hydrolyzed straw. In periods 7 and 8 the straw added was treated with 8.3 kg. of caustic soda as mentioned above, but here the cooking was done without pressure, but for a period of six hours. In period 7 the treated straw was fed with hay, and in period 8 it was fed with blood meal and the sheep received no hay. The following table gives a summary of the 8 tests with wether No. 2:

The digestibility of treated and untreated straw.

Experiment No.	Length of experiment.	Dry matter in hay.	Dry matter in straw.	Coefficients of digestibility of straw.					
				Dry matter.	Organic matter	Crude protein.	Crude fat.	Crude fiber.	N-free extract.
	Days.	Gm.	Gm.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1.....	17	721.5	.....	155.1	157.9	152.0	134.0	159.0	159.3
2.....	11	262.4	363.0	58.4	61.3	.....	16.4	63.2	70.0
3.....	15	256.8	214.1	61.7	66.1	.....	23.6	61.5	81.1
4.....	10	254.2	366.6	39.7	40.0	.....	28.5	49.8	44.9
5.....	10	260.7	219.2	49.6	51.4	14.1	36.6	49.2	56.0
6.....	8	446.7	.....	156.2	158.4	150.0	140.0	162.5	158.3
Average 1 and 6.....	.....	.....	.....	155.7	158.2	151.0	137.0	160.7	158.8
7.....	10	276.0	253.0	.....	58.8	.....	29.5	60.7	50.5
8.....	10	21.5	442.3	.....	58.0	.....	22.3	64.7	59.4

¹ Hay¹ Blood meal.

The starch value from 100 kg. dry matter of the hay fed in the experiments was found to be 35.4 kg., in the straw treated with 4.5 per cent NaOH 45.5 kg., in the straw treated with 1.7 NaOH 50.6 kg., and in the straw from experiment 8 treated with 8.3 per cent NaOH 42.3 kg. The results with wether No. 1, while somewhat more variable, were similar to those as reported from wether No. 2.

To further study the digestible nutrients of straw with and without the caustic soda treatment, two horses and two wethers were used. For these tests untreated straw, steamed straw, and straw treated with 1.5 parts NaOH were each used in one experiment with the horses. With the sheep the straw was treated with 10 parts of NaCl instead of NaOH. The rations fed for the horses consisted of 5,000 gm. of the respective straws and 2,000 gm. of oats in each experiment, and for the sheep 500 gm. of the respective straws and 150 gm. of ground oats. The following table gives a summary of the coefficients of digestibility for the different straws obtained from the horses and the sheep:

Coefficients of digestibility of straw obtained with horses and wethers.

Animal	Straw.	Dry matter.	Organic matter	Crude protein	Crude fat.	Crude fiber.	Pentosans.	N-free extract.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Horses.....	Untreated.....	33.2	35.3	16.0	61.0	33.4	40.6	36.6
Do.....	Steamed.....	38.0	40.5	.....	70.0	45.8	44.1	35.9
Do.....	Treated with 1.5 per cent NaOH.....	44.9	47.9	.....	67.0	55.5	50.5	40.6
Wethers.....	Untreated.....	53.8	55.9	57.5	60.3	43.2	62.5	62.5
Do.....	Steamed.....	60.8	63.6	17.0	70.1	65.2	70.4	67.2
Do.....	Treated with 10 per cent NaCl.....	59.2	59.2	.....	72.8	58.0	80.2	64.4

The following starch values were obtained for 100 kg. of dry matter in the straw by the horse experiments: Untreated straw 11.34 kg., steamed straw 24.97, and straw treated with NaOH 32.73 kg.; and by the sheep experiments untreated straw 35.73 and steamed straw 50.66 kg. Complete tables showing the analyses of all feeds used and the amount of feed and water consumed and the feces and urine produced for each animal are given. The straw used in these experiments was wheat straw, and the Lehmann apparatus was used for the treatments.

The chemical composition and yield of green corn cut at different times, S. WEISER and A. ZAITSCHEK (*Landw. Vers. Sta.*, 97 (1920), No. 1-2, pp. 111-130; *abs. in Zentbl. Gesam. Landw.*, 2 (1921), No. 10, pp. 376-378; *Chem. Zentbl.*, 1921, IV, No. 1, p. 53)—In this study of the composition of samples of green corn during different stages of growth, samples were taken from 11 different sources at irregular intervals from the time the corn started to tassel until it was mature. The weight of the green corn produced on 1 square meter of land was recorded, the sample was dried and analyzed for dry matter, organic matter, ash, crude and pure protein, crude fat, crude fiber, and nitrogen-free extract, and these analyses are reported both on the basis of the green plant, dry matter, and per square meter of land.

For the first 30 days after tasseling there was found to be an average change in the percentage of dry matter from 12.8 to 20.8 per cent. Based on the green plant, the percentages of ash, crude fiber, and nitrogen-free extract were increased with maturity, whereas the other substances remained about the same. The dry matter produced per square meter of land varied greatly in the different experiments, as well as the time required for the corn to reach maturity.

Corn germ, S. WEISER (*Landw. Vers. Sta.*, 97 (1920), No. 1-2, pp. 93-110; *abs. in Zentbl. Gesam. Landw.*, 2 (1921), No. 10, p. 376; *Chem. Zentbl.*, 1921, IV, No. 1, p. 53)—Studies are reported of the composition, feeding value, and keeping qualities of corn germ. The production of corn germ oil at four different mills is first described. From approximately 6.5 to 9.5 per cent of the corn is recovered as germ, of which from 8 to 16 per cent is water, and from 24 to 30 per cent of the corn germ was extracted as oil.

A feeding experiment in which two groups of 10-80 lb. pigs each were fed for 195 days on rations of ground barley and corn meal and ground barley and corn germ meal is reported. The same amounts of feed were fed each lot, but the first lot gained 119.8 lbs. per pig, whereas the second lot gained 130.8 lbs. per pig, showing some advantage for the germ meal, though there was a little less organic matter and nitrogen-free extract in the corn meal ration. In a similar experiment with Berkshire sows like results were obtained.

In studies of the keeping qualities of corn germ, it was found that enzymes were probably present, which hastened decomposition and the production of free fatty acids. By heating corn germ to from 70 to 80° C. (158 to 176° F.) its keeping qualities were found to be markedly increased, due to the destruction of the enzymes causing decomposition.

The comparative effects of parathyroid and thyroid feeding on growth and organ hypertrophy in the white rat, A. T. CAMERON and J. CARMICHAEL (*Amer. Jour. Physiol.*, 58 (1921), No. 1, pp. 1-6).—Four series of experiments on feeding parathyroid tissue to rats are reported. All rats received a basal ration of bread and milk which was supplemented by stated amounts of experimental material. In the first three experiments desiccated beef parathyroid (iodine free) was used, with desiccated beef liver as the control, whereas in the fourth experiment a comparison of the effects of parathyroid powder and thyroid was made. In each of experiments 1 and 2, 5 male rats were fed for 18 and 36 days, respectively, with the following daily ratios of experimental substances to body weight: Experiment 1 liver 1:500, parathyroid 1:5,000, parathyroid 1:2,000, parathyroid 1:500, and 1 control (bread and milk only); experiment 2 liver 1:500, parathyroid 1:1,000, (2 rats) parathyroid 1:500, and 1 control. In experiment 3, which lasted 18 days, 5 female rats were used, of which 2 were kept as controls, whereas the others received the following supplements in ratio to body weight: Liver 1:500 and parathyroid

1:1,000 (2 rats). In the fourth experiment, which lasted 11 days, 6 females were fed as follows: One control, 1 on liver, 2 on parathyroid 1:500, and 2 on thyroid 1:5,000. During the tests the rats were weighed regularly, and at the conclusion they were killed and weighings made of the liver, kidneys, heart, spleen, adrenals, thyroid, muscle (right anterior tibialis), and lymph glands.

There was considerable variation in the growth of the rats, but no uniform effect on growth or on organ hypertrophy even with these very heavy doses of parathyroid tissue was found. Tetanus was produced in the rats in experiment 4, which received thyroid, on the tenth day and they died soon after.

The effect of thyroid feeding on growth and organ hypertrophy in adult white rats, A. T. CAMERON and F. A. SEDZIAK (*Amer. Jour. Physiol.*, 58 (1921), No. 1, pp. 7-13).—An experiment in feeding mature rats on 1 part of thyroid (0.38 per cent iodine) to 5,000 parts of body weight is reported. The thyroid was mixed with flour and water as a thick paste and given to 5 males and 2 females for 18 days. Four males and 1 female were kept as controls, and data were collected as in the experiment reported above. The treated rats did not maintain their body weight as well as the controls, they showed distinct hypertrophy of the heart, liver, kidneys, adrenals, spleen, and lymph glands, and the muscle showed a distinct wasting.

Feeds and feeding manual, E. S. SAVAGE and F. B. MORRISON (*Madison, Wis.: Henry-Morrison Co., 1920, 3. ed., rev., pp. 165*).—This is a revised edition of the laboratory manual previously reported (*E. S. R.*, 34, p. 565).

Sterile hybrids, K. KUIPER, JR. (*Genetica [The Hague]*, 2 (1920), No. 4, pp. 289-299, figs. 6).—Sterile crosses between various closely related species of birds have been made by R. Houwink, of Meppel, Holland. Some of these sterile hybrids would not even mate and were found to have abnormal genital organs, whereas others would breed but would not produce young. In most cases the genitals were deformed, but in some cases sterility could only be explained by the production of imperfect sperm or egg cells. A review of the literature on sterile and fertile hybrids is also given.

[Report of] **division of animal husbandry,** W. H. PETERS, N. K. CARNES, E. F. FERRIN, and S. D. LAW (*Minnesota Sta. Rpt. 1921, pp. 50, 51*).—In a feeding test with six lots of eight 2-year-old steers each, from December 30, 1920, to April 20, 1921, the results indicated that ground barley was fully equal to shelled corn, pound for pound, in making gains on 2-year-old steers; and that shelled corn and clover hay without supplements made cheaper gains than when supplemented with linseed meal alone or both linseed meal and corn silage.

Results of a trial in the feeding of alfalfa hay to brood sows indicated that a ration including from 20 to 25 per cent alfalfa hay is not only economical but beneficial to the strength and condition of the pigs produced.

The farmers' meat ring, C. W. McDONALD (*Iowa Agr. Col. Ext. Bul. 88 (1922), pp. 16, figs. 8*).—A description is given of the organization and management of a farmers' meat ring as it is carried on in Iowa. Directions and diagrams are furnished showing the best methods of cutting beef and lamb to give an equal distribution of the cuts to each member.

Feeding steers under southern conditions, J. C. GRIMES (*Ala. Polytech. Inst. Ext. Circ. 52 (1922), pp. 12*).—This discussion of the feeding of steers makes special reference to the profit to be obtained by wintering steers in the South.

The intensive production of beef, DECHAMBRE (*Compt. Rend. Acad. Agr. France, 6 (1920), No. 33, pp. 795-798*).—This is a discussion of the production

of baby beef in France, with special reference to the feed and time required to get baby beeves ready for market.

The cattle of Madagascar with reference to slaughtering animals, M. CHRÉTIEN (*Rev. Zootech. [Paris]*, No. 5, (1922), pp. 395-409, figs. 6).—This is a description of the cattle of Madagascar, having special reference to those brought to abattoirs for slaughter, the quality of the meat, dressing percentage, size of the animals, and the parasites and diseases which injure the meat, as well as a brief discussion on the manufacture of canned meats.

History of the Charmoise breed of sheep (1910-1922), M. LAPLAUD and A. GARNIER (*Rev. Zootech. [Paris]*, No. 5, (1922), pp. 447-462, figs. 12).—This is a discussion of the history of Charmoise sheep, explaining how they originated by crossing and selection. A description and comparison is given of sheep from two different herds, one being the Vaulx-de-Cernay Station herd, showing the development which has taken place. Measurements of the different parts of sheep are also given.

Sheep raising in Argentina, L. G. CONNOR (*Natl. Wool Grower*, 11 (1921), No. 12, pp. 10-12, figs. 3).—A rather popular description of sheep production in Argentina is given in this article. The methods of breeding, feeding, and caring for the sheep are noted.

The goats of the Mediterranean, C. MANETTI (*Agr. Colon [Italy]*, 14 (1920), No. 9, pp. 367-376).—This is a description of the types and varieties of goats found in the countries bordering on the Mediterranean Sea. The wild goats are first taken up, followed by the breeds of Alpine, Pyrenees, and Spanish goats. The strains of Angora goats, as well as their distribution and value, are also discussed.

The acid-base balance in animal nutrition.—I, The effect of certain organic and mineral acids on growth, well-being, and reproduction of swine. II, Metabolism studies on the effect of certain organic and mineral acids on swine, A. R. LAMB and J. M. EYVARD (*Iowa Sta. Research Bul.* 70 (1921), pp. 173-192).—These studies have been noted, from another source. (*E. S. R.*, 42, p. 206).

The acid-base balance in animal nutrition.—III, Effect of addition of alkalis to the ration on growth and well-being of swine, A. R. LAMB and J. M. EYVARD (*Iowa Sta. Research Bul.* 71 (1921), pp. 193-208, figs. 4).—This is the third of the series of studies noted above and deals with the effect of the addition of alkalis and acids on the growth and condition of swine. A discussion is first given of Forbes' criticism¹ of Studies I and II, and then experiments are reported in which 5 lots of three 130-lb. pigs each, fed on the same basal ration as in Study I, received the following acid and alkali feeds in equal amounts during eight periods of approximately 30 days each: Lot 1 (control) no alkali or acid, lot 2 sulphuric acid, lot 3 sodium hydroxid, lot 4 sodium carbonate, and lot 5 sodium sulphate.

The amount of acid or alkali given was gradually increased, so that from 90 to 120 days (period 4) the pigs each received 500 cc. of normal acid or alkali solution per day for the 30 days. During this period the pigs averaging 260 lbs. in weight consumed 7.83 lbs. of feed per day per pig and made an average daily gain of from 1.33 to 1.53 lbs. per pig. The lowest gain was made by the control lot.

During period 5, in making an attempt to find the upper limit of acid or alkali consumption, 1,000 cc. of the normal solutions were given to each pig per day. This soon threw the acid-fed pigs off feed, with other bad results, so that the amount was again reduced to 500 cc. and gradually increased to 1,000 cc.

¹ *Jour. Biol. Chem.*, 42 (1920), No. 3, pp. 459-463.

with similar bad results, indicating that the pigs could not handle that much acid. The approximate daily limits of consumption of the normal solutions were determined to be 500 cc. for the sulphuric acid, 750 cc. for the sodium hydroxid, and above 1,000 cc. for the sodium carbonate and sodium sulphate. The consumption of normal acid or alkali up to 500 cc. seemed not to affect the gain or the feed consumed per pound of gain.

One pig from lot 1 and 1 from lot 2 were slaughtered after the test, and the intestinal contents of the acid-fed pig were found to be acid throughout with a slightly lighter color of the membrane than in the control. The bones of the acid-fed pig were harder than those of the control pig, with less marrow in the leg bones, though this may have been due to the individuality of the pigs.

Tables are given showing the feed and water consumed, gains per day, and feed consumed per 100 lbs. gain during each period, as well as photographs of the bones from the control and acid-fed pigs which were slaughtered.

Self-feeding swine, W. L. ROBISON (*Ohio Sta. Bul. 355 (1922), pp. 19-50, figs. 6*).—Fifteen experiments comparing hand-feeding and self-feeding for hogs in dry lot and on forage are reported, as carried on from 1914 to 1920, many of which have been previously noted (*E. S. R.*, 45, p. 674), and in other earlier works. The following table gives a summary of the more recent experiments. In most of the experiments where two or more feeds were self-fed, the hogs had free choice of either feed in separate boxes and thus balanced their own ration, but in some of the experiments the feeds were mixed in definite proportions and placed in the self-feeders, as will be noted in the following table, together with other data:

Summary of self-feeding v. hand-feeding experiments in 1919 and 1920.

Ex- peri- ment No.	Condi- tions of experi- ments.	Feeds.	Propor- tion of feeds.	Method of feeding.	Num- ber of pigs	Average initial weight.	Average final weight.	Average gain per day.	Daily feed per pig.	Feed per 100 pounds gain.
						<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
3....	Dry lot...	Corn and tankage	(11.69:1... 11.93:1... 20:7:1...	Self-fed.... Hand fed.... Self-fed....	5 5 6	43.6 44.4 65.75	243.4 244.0 243.83	1.297 1.188 1.696	5.341 4.655 6.700	414.7 391.8 395.0
4....	do.....	do.....	(12:1... 15.08:1... 16.5:1...	Hand fed.... Self-fed.... Self-fed	6 6 6	66.33 66.25 65.58	249.58 228.75 220.08	1.378 1.786 1.839	5.168 6.964 6.826	375.1 390.0 371.1
9....	{ Rape pas- ture. }	do.....	19:1.....	Hand feed- ing. ¹	5	58	220.4	1.380	4.483	324.8
			19:1..... 6.5:1.....	do. ² Self-fed....	5 5	65.5 63.5	218.3 143.1	1.205 .812	3.755 2.915	311.7 482.0
12...	Dry lot	{ Corn and linseed meal Corn, linseed meal and tankage. Corn and linseed meal.	18.8:2:1... 8:1.....	{ Self-fed ³ .. do..... } Mixture...	5 5	62.8 63.1	198.6 136.7	1.396 .751	5.718 3.796	412.6 504.5
13....	do.....	do.....	(25:2:1... 5:5:1.....	{ Self-fed.. Self-fed (mixed)	4 4	148.9 118.7	245.6 242.1	1.382 1.667	8.287 9.092	599.6 545.2
14....	do.....	{ Hominy and tankage.	(7.54:1... 12:1.....	{ Self-fed.. Self-fed (mixed)	4 4	72.7 72.7	157.9 164.0	1.252 1.418	5.307 6.300	424.0 431.9
15....	do.....	{ Barley and tank- age	(9.07:1... 14:1.....	{ Self-fed.. Self-fed (mixed).	4 4	72.6 72.1	215.9 214.7	1.705 1.852	8.483 8.263	497.5 446.1

¹ Limited, followed by full feed.

² Limited.

³ Linseed and tankage mixed.

The general results of self-feeding and hand-feeding in the dry lot indicate that the self-fed pigs eat more and thus make a higher rate of gain so that they can be marketed a week or two earlier, but hand-feeding seems to pro-

duce a little greater gain per unit of feed. Practically the same results were obtained with feeding on forage. The self-fed pigs gained about 16 per cent more rapidly, but there was found to be a little more economical use of the feed with hand-feeding.

In the comparisons with self-feeding of supplements to corn in mixtures and in separate boxes, the mixtures produced more rapid gains in all cases, though this was usually done with less economy as to the feed required per unit of gain. "When given an opportunity to choose whatever proportions of the feeds they cared for, pigs not only showed an inclination to take an insufficient amount of the nitrogenous feed if it proved to be distasteful and was fed with a palatable carbonaceous feed, but also showed a tendency to consume a larger amount of the high-protein feed than was needed when the carbohydrate feed offered was less palatable than the supplement used."

Gloucestershire Old Spots pigs, S. SPENCER (*Jour. Min. Agr. [London]*, 28 (1922), No. 12, pp. 1105-1109, pl. 1).—This is an account of the history, description, and economic importance of the breed of Gloucestershire Old Spots pigs in England. A standard for the typical pig of this breed is included.

The entry of horses in the studbook, H. M. KROON and G. M. V. D. PLANK (*Genetica [The Hague]*, 2 (1920), No. 4, pp. 347-364, figs. 3).—The authors discuss the inclusion of a more comprehensive description of animals listed in studbooks in order that they may be of more assistance in determining the genetic constitution of the animals for selection in breeding. Several methods of conveying an idea of the characteristics of animals are suggested as follows: By a complete description of each animal, by scoring each animal with score cards, by measurements of the various parts of the animals or by descriptions of the different parts, and by giving the characteristics of each animal by means of signs and symbols. The last method is recommended and is described in detail, with signs suggested by which it would be possible to describe completely the different parts and characteristics of a horse and yet take up only a little space in the studbook.

The modern farm hen, C. C. SHERLOCK (*Des Moines, Iowa: Homestead Co.*, 1922, pp. 236, figs. 70).—This book contains practical instructions for farm poultry raising, being especially adapted for the use of farmers with small flocks.

Best methods of feeding [poultry], H. A. NOURSE ET AL. (*St. Paul, Minn.: Poultry Herald*, 1921, pp. 31, figs. 30).—This is a popular description of the methods of feeding little chicks, growing chicks, fowls, turkeys, ducks, and geese for eggs, for market, and for exhibition, with formulas of rations for each purpose.

Feeding for eggs, J. G. HALPIN and J. B. HAYES (*Wis. Agr. Col. Ext. Circ.* 141 (1922), pp. 16, figs. 2).—This is a popular description of the principles of feeding hens for egg production. Several sample rations are also included.

The culling and feeding of poultry, B. F. KAUPP (*N. C. Agr. Col. Ext. Circ.* 126 (1922), pp. 7, figs. 2).—Brief directions for the culling and feeding of chicks and hens are given. Sample rations are also included.

Reports on demonstration poultry crofts (*West of Scot. Agr. Col. Buls.* 91 (1919), pp. 11; 99 (1921), pp. 177-187).—The first of these bulletins gives the reports of the Thre and Glenluce poultry demonstration crofts from 1915 and 1916, respectively, to October, 1918, dealing with the breeds, costs, and receipts from these flocks during this time, together with the rations fed and notes on the care and management. The second bulletin reports similar data obtained at these crofts from October, 1918, to September 30, 1920, and also at the Jura croft from October, 1919, to September, 1920.

Hens v. pullets for profitable egg production, C. G. SELVIG (*Minnesota Sta. Rpt. 1921, p. 97; Crookston Substa. Rpt. 1920, pp. 72, 73, fig. 1*).—A progress report is given of four years' results of an experiment in which the egg production of pullets has been compared with a second year's production. The average egg production per bird during the different years was, respectively, for pullets and hens 117.4 and 126, 120.9 and 115, 114 and 107, and 122 and 114. From the results so far it seems to pay to keep hens through their second laying year.

Egg-turning experiment, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 73, 74*).—Two lots of 180 White Leghorn eggs each were held 7 days before incubating, during which time one lot was turned daily. Hatching these eggs in the same incubator showed that 77.5 and 77 per cent, respectively, of the turned and unturned fertile eggs hatched.

A preliminary study as to the possible correlation between the components of the egg and hatching results, F. A. E. CREW (*Natl. Poultry Jour., 2 (1922), No. 98, pp. 621, 622*).—In this report from the animal breeding research department of Edinburg University, eggs from Rhode Island Reds, Anconas, White Leghorns, Light Sussex, Black Leghorns, and White Wyandottes were analyzed for the percentage of shell, yolk, and albumin. The standard percentages were found to be, respectively, 11, 32, and 57 per cent. No relation could be determined between the composition and hatching ability, but the eggs were found to be more variable in their albumin content than in any of the other constituents.

A method of determining sex of chicks at hatching time, L. C. DUNN (*Rel. Poultry Jour., 29 (1922), No. 3, pp. 331, 332, 362, 363, figs. 3*).—The suggested method of determining the sex of chicks at hatching time is based on the inheritance of sex-linked characters in poultry. It would be possible to make these determinations only in case of crosses where barring or other similar characters are involved.

Comparative cost of heating brooders, C. G. SELVIG (*Minnesota Sta. Rpt. 1921, p. 97; Crookston Substa. Rpt. 1920, p. 73*).—In comparing the cost of fuel for brooding chicks in hard coal and kerosene brooders, it was found during 1920 that the cost of fuel per 100 chicks in the coal brooders was \$1.08 as compared with \$2.87 for the kerosene brooders.

Columbian Plymouth Rocks, J. W. BOWEN (*Vet. Alumni Quart. [Ohio State Univ.], 9 (1921), No. 2, p. 46*).—This is a history of the development of Columbian Plymouth Rock chickens.

Rabbit raising [and] sanitary care of rabbits, M. D. COLLINS and S. LOCKETT (*Nev. Agr. Col. Ext. Bul. 29 (1922), pp. 34, figs. 12*).—This is an elementary description of the methods of care, management, and breeding of rabbits, especially as applied to back-yard conditions. A description of the more important breeds of rabbits is also given.

DAIRY FARMING—DAIRYING.

The feeding of milch cows.—A contribution to determine the milk-producing effect of feeding stuffs, especially hay and corn germ meal, W. THOMANN (*Landw. Jahrb. Schweiz. 34 (1920), No. 2, pp. 73-93, fig. 1; abs. in Zentrbl. Gesam. Landw., 2 (1921), No. 10, pp. 380-382*).—This is the report of a study to determine the feeding value of corn germ meal and hay for milk production. For this experiment 2 lots of four Simmentaler cows each were selected, nearly equal as to the stage of lactation, total weight, and milk production. The experiment lasted 18 weeks, during which time lot A was used as a control lot and was fed a daily ration of 20 kg. of hay, 28 kg. of

rowen, and 12 kg. of corn germ meal. During the first 3 weeks and the last 4 weeks lot B was fed the same as lot A, whereas from the fourth to the tenth week each kilogram of corn germ meal in the control ration was replaced by 1.7 kg. of hay, thus increasing the hay to 40.5 kg., and from the eleventh to the fourteenth week the hay was further increased to 48.5 kg.

In comparing the energy (starch equivalent) and the amount of digestible protein in the daily rations during the experimental periods, lot B was found to receive 0.42 kg. less starch value and 0.4 kg. less digestible protein than lot A during the first experimental period (fourth to tenth week) and 2.31 kg. more starch value and 0.07 kg. less digestible protein during the second experimental period (eleventh to fourteenth week). During the entire 18 weeks there was found to be a gradual fall in milk production with the control lot, but in lot B this fall was very marked during the fourth week. After it reached a certain plane it again continued to fall at about the same rate as lot A until the fifteenth week, when there was a distinct rise in milk production which corresponded to having the control ration again supplied.

For the respective periods the average weekly milk production of lot A was found to exceed the production of lot B by 4, 70.8, 65.4, and 13.5 kg., respectively. While the amount of energy in the rations of lot B during the second test period was greater than that of lot A and the amount of digestible protein was nearly equal, the milk production during these two periods was markedly lower. The kind of feeds supplying the energy and digestible protein is evidently important, and the amounts of energy and protein present are not entirely responsible for the milk production. The following table shows the energy and digestible protein consumed per kilogram of milk produced during each period:

Energy (starch equivalent) and digestible protein consumed per kilogram of milk produced

Period	Lot A.		Lot B.	
	Starch value	Digestible protein.	Starch value.	Digestible protein.
	Kg.	Kg.	Kg.	Kg.
First to third week	0.374	0.054	0.378	0.054
Fourth to tenth week	.413	.059	.484	.063
Eleventh to fourteenth week	.470	.067	.621	.080
Fifteenth to eighteenth week	.492	.071	.512	.073

By computations it was shown that from this test it would be unreasonable to accept some of the common maintenance requirements as suggested for cattle, and in this case a more reasonable maintenance requirement for 1,000 kg. live weight for cattle would be 0.25 kg. digestible protein and 4.7 kg. of starch value. This indicates that different breeds of cattle and different feeds have a different influence on the energy and digestible protein required for maintenance.

[Report of the] division of dairy husbandry, C. H. ECKLES ET AL. (*Minnesota Sta. Rpt. 1921, pp. 53-55*).—Preliminary results of experiments carried on by the author, T. W. Gullickson, and J. W. Wilbur indicate that the full amount of energy as specified by Armsby is required for calves under 10 months, but as the age of the animals increases the excess of nutrients supplied by Armsby's standard increases until at 18 months about 80 per cent of the energy standard is sufficient. Four calves fed whole milk as a sole diet

showed abnormal conditions which were not corrected by yeast or orange juice, but were corrected by calcium carbonate. In work by the author and M. H. Fohrman growth approximating 90 per cent normal at six months of age was obtained on the average with 23 calves by discontinuing milk at from 45 to 60 days of age and feeding alfalfa hay and a mixture of corn, bran, and oil meal. Work by H. Macy indicated that when possible to deliver milk to a receiving station within two hours after milking, cooling was not important if the cans were well sterilized.

In tests by the author, E. C. Stakman, and C. P. Fitch from 10 to 20 lbs. of moldy silage fed daily to three head of cattle from December 1 to April 1 apparently did no harm to the cattle.

Report on the society's dairy department at Salisbury, A. F. SOMERVILLE (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 80-84).—The educational work performed by the dairy department of the Bath, West, and Southern Counties Society at the Salisbury show is described. Demonstrations were given in butter making, competitions were held, and tests were run for fat and milk production, as well as demonstrations of buying and selling milk, cream, butter, and cheese.

The milk-test classes at Salisbury, J. A. VOELCKER (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 85-90).—This is a report of the contest for fat and milk production at the Salisbury show, in which 33 cows competed.

The dairy herd competition at Salisbury (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 97-99).—This is a description of the dairy herd competition at the Salisbury show. In this competition the judge visited the farm of each entry, and scored each herd on milk production, appearance of herd and young stock, bulls, and general management of the herd. The judges' report is also included.

Milk recording, H. JACKSON (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 25-30).—The system of milk recording in England and the results which have been obtained from 1915 to October, 1920, are discussed.

Testing of purebred dairy cows, W. M. SINGLETON (*New Zeal. Jour. Agr.*, 24 (1922), No. 3, pp. 129-146, figs. 5).—During 1921, in the testing of purebred dairy cattle in New Zealand, a total of 525 first class certificates were issued to cows not previously tested, as well as 83 repeat certificates. Due to the large number of animals tested, it was necessary to restrict the sampling to one day per month.

Herd testing, season 1919-20, F. H. JOHNSTONE and E. F. RAMSKILL (*Tasmania Dept. Agr. Bul.* 99 (1920), pp. 9).—A summary is given of the official testing of dairy cattle in Tasmania during 1919-20, as well as notes on the five cow-testing associations and the records made by animals entered in them.

Influence of temperature on fat content of milk, F. RASMUSSEN (*Creamery and Milk Plant Mo.*, 11 (1922), No. 5, pp. 32, 33; also in *Mælkeritid.*, 34 (1921), No. 25, pp. 349-352).—This is a discussion of the butter-fat content of the milk from Jersey and Danish cattle. It is concluded that the cooler the climate the higher will be the fat content.

The keeping qualities of grade A (certified) milk, K. FREEAR, A. T. R. MATICK, and R. S. WILLIAMS (*Jour. Hyg. [London]*, 20 (1921), No. 4, pp. 371-376, fig. 1).—Continuing the work previously reported (*E. S. R.*, 46, p. 176), a study of the keeping qualities of morning milk, which arrived at the laboratory 30 hours old from one farm from August 18, 1918, to August 24, 1919, is re-

ported. The milk was kept in the laboratory at different temperatures, and records of the time required for souring are given.

The season of the year was found to make a great difference in the keeping qualities of the milk, the average time from October to April being nearly twice as long as from May to September. The temperature of the milk on arrival and the temperature of storage also had a marked effect on the keeping qualities. It was found that milk arriving at temperatures between 61° and 70° F. could not be relied upon to keep sweet longer than 2.8 days from the time of milking. It is concluded that milk should not be allowed to go above 60° if it is not delivered to the consumers in less than 2 days because the period of keeping sweet is so short.

Investigations of the bacterial flora of normal cows' udders, W. STECK (*Landw. Jahrb. Schweiz*, 35 (1921), No. 5, pp. 511-629, figs. 3).—In studies of the bacterial contents of milk aseptically drawn from the different quarters of healthy and infected udders of 17 different cows at intervals during one or more lactation periods, quantitative and qualitative counts were made of the number of bacteria and the number of body cells in the milk drawn from the different quarters of the udder at different times during milking for evening and morning milk.

The results of the investigation showed that the number and type of organisms remained quite constant for any one quarter of the udder, but that the different quarters of the udder were often variable. In certain cases one-quarter of an udder would constantly produce many more bacteria in the milk, mainly of a different kind, than were produced in the other quarters. There also seemed to be some relationship maintained between the number of body cells in the milk and the number of bacteria.

The difference between pathological inflammation and normal inflammation of the udder was shown to be relative with all intermediate stages, and the possibility is suggested that larger numbers of the normal bacteria or lowering of the resistance of the animal may tend to cause pathological inflammation in the udder.

Disorders of the milk formation and their connection with the natural bacterial flora of the udder, G. KOESTLER, W. STECK, and M. RADOSAVLEVITCH (*Landw. Jahrb. Schweiz*, 35 (1921), No. 5, pp. 631-654).—In continuing studies previously noted (E. S. R., 44, p. 575), the authors report the results of analyses of the milk from each quarter of the udders of six different cows of different ages and at different periods of lactation. One quarter of the udders of three of the cows was inoculated with a culture of streptococci, and analyses of the milk from each quarter were reported at four succeeding periods during lactation from one day to several days apart, as well as the bacterial counts and the type of bacteria most prevalent. The chemical analyses of the milk showed some variation, but did not seem to be uniformly affected by the bacterial flora.

The relation between the volatile and total acidity in starters and in cultures of *Streptococcus lacticus*, W. A. CORDES and B. W. HAMMER (*Iowa Sta. Research Bul.* 66 (1921), pp. 129-136).—A study of the volatile and total acidity produced in milk by starters and by pure cultures of *S. lacticus* is reported. The methods are similar to those used in previous work by Hammer (E. S. R., 46, p. 76).

In this study the percentage of the acidity due to volatile acids was determined at irregular intervals, from approximately 15 to 87 hours in some cases, after inoculation of the milk with starters from five different sources. The samples of milk used were all pasteurized before inoculation, and the incubation was carried on at 21° C. The results showed that with the ordinary

starter, when the total acidity was low, approximately 0.3 per cent, the volatile acid content of the acidity was also low, being about 3 per cent, but as the total acidity increased to about 1 per cent the percentage which was volatile acids also increased to from 10.2 to 14.8 per cent.

In studies in which the milk was inoculated with pure cultures of *S. lacticus* it was found that the volatile acid percentage of the total acids stayed practically uniform with an increase in total acidity, and in no case did it go over 6.7 per cent of the total acidity.

Mixtures of *S. lacticus* and *S. citrovorus* were found to give approximately the same results in the production of volatile acids as the starters. When milk inoculated with starter was incubated at 37° the production of volatile acids remained essentially the same as when the pure culture of *S. lacticus* was used, whereas similar milk inoculated at 21° showed the typical increase in volatile acids. *S. citrovorus* can not grow at the higher temperature. The authors conclude that starters are not pure cultures of *S. lacticus*, and that possibly starters may be developed which will produce higher aroma and flavor accompanied by less activity.

Sources of the flavor in butter, R. W. HAMMER (*Iowa Sta. Research Bul. 67 (1921), pp. 139-144*).—A study of the quality of butter made from cream ripened by *Streptococcus citrovorus* and *S. paracitrovorus* is reported.

As suggested above, *S. citrovorus* in a number of tests, especially with from 0.1 to 0.2 per cent citric or lactic acid added, was found to produce butter which would score slightly higher than butter produced from cream inoculated with *S. lacticus* or without any inoculation. Similar results were obtained with *S. paracitrovorus*. It is the author's conclusion that *S. lacticus* has an important rôle to play in the production of aroma, but the organisms associated with it in the starter seem to be the important ones, and a proper balance must be maintained between all in a good starter. The pronounced acid production of *S. lacticus* also probably tends to prevent the growth of undesirable bacteria.

Burnt or caramel flavor of dairy products, R. W. HAMMER and W. A. CORDES (*Iowa Sta. Research Bul. 68 (1921), pp. 147-156*)—A study was made of the cause of burnt or caramel flavor of butter and other dairy products.

The results indicate that caramel flavor is due to an organism which differs from *Streptococcus lacticus* only by causing this peculiar flavor, and tentatively called *S. lacticus* var. *multigenus*. In efforts to isolate this organism from samples of caramel flavored butter and cream negative results were obtained in a few cases. These were attributed, however, to errors in judging the flavor or to overgrowth or death of the organisms. Organisms causing the typical caramel flavor were isolated from cream not showing the flavor, cow's feces, and water in a cooling tank. Experiments showed a distinct relation between the amount of caramel flavor in the butter and the number of organisms added to cream.

Viscolizing the ice cream mix, Z. G. GASSMANN (*Creamery and Milk Plant Mo., 11 (1922), No. 5, pp. 68, 69; also in N. Y. Prod. Rev. and Amer. Creamery, 53 (1922), No. 24, pp. 1246, 1247*).—In this paper, given before the Illinois Association of Ice Cream Manufacturers, the author first draws attention to the similarity between homogenizers and viscolizers. The work of the viscolizer is accomplished by forcing the liquid mix through a very small aperture between surfaces of sufficient depth to break apart the fat globules. The pressure required in the viscolizers averages about 2,000 lbs., whereas in the homogenizers 3,000 lbs. is required, due to the larger valve. The viscolizer and homogenizer have also been satisfactorily used for reconverting cream from butter and milk powder.

VETERINARY MEDICINE.

[Report of the] division of veterinary medicine, C. P. FITCH ET AL. (*Minnesota Sta. Rpt. 1921, pp. 82-88*).—In this report considerable attention is given to investigations being made of bovine infectious abortion and of contagious abortion of mares and pyemic arthritis of foals. A study of an organism associated with nephritis in sheep led to its description under the name *Bacillus nephritis ovis*. This organism is said to be compared with the one producing equine nephritis and arthritis, namely, *B. nephritis equi*. Studies of the pathology of sterility in bovine infectious abortion are also reported upon.

The intestinal protozoa of man, C. DOBELL and F. W. O'CONNOR (*London: John Bale, Sons, & Danielsson, Ltd., 1921, pp. XII+211, pls. 8, figs. 2*).—This work contains much data of interest to the veterinarian, and includes a bibliography of 18 pages.

New and nonofficial remedies, 1922 (*Chicago: Amer. Med. Assoc., 1922, pp. 417+XXXIV*).—This is the usual annual report (E. S. R., 46, p. 880).

Origin and history of all the pharmacopoeial vegetable drugs, chemicals, and preparations with bibliography.—I, Vegetable drugs, J. U. LLOYD (*Washington, D. C.: Amer. Drug Mfrs. Assoc., 1921, vol. 1, pp. XIV+449, pls. 19*).—This volume consists of the history, with reference data, of all the vegetable drugs listed in the eighth and ninth decennial revisions of the U. S. Pharmacopoeia. An extensive bibliography is appended.

Phenol and cresol as preservatives in biologic products, P. MASUCCI (*Jour. Infect. Diseases, 30 (1922), No. 4, pp. 379-387*).—Contrary to the results reported by Krumwiede and Banzhaf (E. S. R., 45, p. 881), ether-cresol has been found to be slightly less rather than more germicidal than cresol alone, and is considered to have no advantage over cresol alone as a preservative of serum. No marked difference was noted in the amount of the precipitate formed on standing between serums treated with cresol or ether-cresol.

Antibody production after intratracheal injection of antigen, R. D'AUNOY (*Jour. Infect. Diseases, 30 (1922), No. 4, pp. 347-356, figs. 6*).—The method of antibody production by intratracheal injections of antigen, as suggested by Besredka (E. S. R., 45, p. 279), has been tested in guinea pigs and rabbits for the production of agglutinins, precipitins, bacteriolyins, and bacterioidins.

Agglutinins for *Bacillus typhosus* and *B. dysenteriae* were produced in as large quantities and as early as when the intravenous route was used and in much larger quantities than by intraperitoneal injection. The same was true for precipitin formation following the intratracheal injection of human and horse serum.

Hemolysins produced by human and sheep erythrocytes appeared more slowly following intratracheal than intravenous injection, but the final titers of the serums were practically identical.

Bacteriolyins for *Vibrio cholerae* were found earlier and in larger quantities following intratracheal than intraperitoneal injection. No fatal results followed any of the attempts at producing various antibodies by intratracheal methods.

The formation of antibodies following injections of mallein, BROCC-ROUSSET, P. FORGEOT, and A. URBAIN (*Ann. Inst. Pasteur, 35 (1921), No. 12, pp. 879-892*).—An investigation to determine whether mallein causes the formation of antibodies in the organism of the animal injected and, if so, within what limits of time after malleinization the complement fixation reaction should be made to obtain conclusive results is reported briefly.

Antibodies were formed in two out of four cases following intradermal injection of mallein and in four out of five cases following subcutaneous injection.

tion. These antibodies appeared from the fourth to the eighth day after the injection of mallein and disappeared in every case after the forty-fifth day. In animals suffering from glanders the content of antibodies in the serum was increased noticeably by the injection of mallein. It is concluded that if the complement fixation test is given in connection with the mallein test the blood for the former should be taken immediately after malleinization, or at least within four days or not until 45 days after malleinization.

Hematological researches in experimental blackleg, V. RONCA (*Clin. Vet., Rass. Polizia Sanit. e Ig.* [Milan], 45 (1921), No. 23-24, pp. 676-694).—A systematic study is reported of the variation in numbers and morphology of the red and white corpuscles of the blood of guinea pigs in a state of infection, in intoxication with the active filtrate of blackleg during the course of immunization with the toxin, and during specific or nonspecific (protein) therapy. The results are summarized as follows:

In experimental blackleg in guinea pigs there is noted first a decided increase, followed by a progressive decrease in the neutrophilic leucocytes. During experimental intoxication with the filtrate of blackleg cultures there appears to be a qualitative alteration in the red and white corpuscles with the production and discharge into the circulation of immature red cells.

In attempted immunization, animals which succumb show changes similar to those of simple infection, while those that survive show a progressive increase in the neutrophilic leucocytes. Nonspecific and specific therapy is always followed by leucopenia. In cases with favorable outcome this is succeeded by a leucocytosis.

Experimental investigation of foot-and-mouth disease.—VI, The virulence of the blood in cases of foot-and-mouth disease in guinea pigs, cattle, and swine, C. VON SEIGNEUX (*Berlin. Tierärztl. Wchnschr.*, 38 (1922), No. 2, pp. 16, 17).—In this continuation of a series of studies on experimental foot-and-mouth disease, the preceding paper of which by Waldmann and Pape has been previously noted (*E. S. R.*, 46, p. 774), the author has determined the time of appearance of the virus of foot-and-mouth disease in artificially inoculated animals to be as follows:

In guinea pigs the virus can be detected in the blood when the pustules at the site of vaccination can first be differentiated, i. e., in from 14 to 20 hours, and circulates in the blood up to the time when generalized pustules are formed, 48 to 54 hours. In cattle the virus can be detected in the blood at the height of pustule formation at the site of vaccination (44 hours) and disappears when generalized aphthae are clinically detectable (68 hours). In swine the virus appears and disappears under similar conditions, the time of appearance being about 29 hours and disappearance 50 hours after inoculation.

Immunization with Loeffler serum for foot-and-mouth disease, O WALDMANN (*Berlin. Tierärztl. Wchnschr.*, 38 (1922), No. 8, p. 88).—In response to the report of unfavorable results following the vaccination of cattle against foot-and-mouth disease, the author emphasizes certain points which must be taken into consideration.

For passive immunization at least 200 cc. of the serum must be used for grown animals. The protection thus acquired is of very brief duration, consequently it is considered inadvisable to practice this method of vaccination on a noninfected herd. The rational method is considered to be the use of simultaneous and curative vaccination. In the former the animal receives first a small dose of serum, from 3 to 5 cc. per 100 weight. This is followed by smearing the mouth with saliva from the infected animal. The simultaneous method should be used only for noninfected animals in an infected herd. The animals which

have already contracted the disease should receive the serum alone in amounts of 10 cc. per 100 weight.

The value of the complement fixation and agglutination tests in the diagnosis of glanders, Á. MARCIS and R. MANNINGER (*Berlin. Tierarztl. Wchnschr.*, 36 (1920), No. 29, pp. 333-335).--The results are reported of serological tests and post-mortem findings in 380 horses condemned as glandered. The data obtained were analyzed with respect to the following questions: (1) How often is the anatomical diagnosis of the slaughtered animals in agreement with the blood tests, and (2) how often in positive cases of glanders have the blood and eye tests failed?

In answer to the first question the data obtained show that of 296 cases in which the complement fixation test gave positive results, 286 proved on autopsy to have glanders. With the agglutination test there were 246 positive results confirmed in 239 cases, while in the eye test there were 228 positive reactions confirmed in 213 cases. Of the 286 cases giving positive results on autopsy, the eye test alone failed in 8 per cent, the agglutination test in 14, the complement fixation test in 12, the combination eye and agglutination test in 3, the agglutination and complement fixation test in 5, the eye and complement fixation test in 2, and the combination of the three tests in 2 per cent.

Prophylactic vaccination of dogs against rabies, A. EICHMORN and B. M. LYON (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 1, pp. 38-42).--A brief description is given of the method employed by Umeno and Doi¹ for the prophylactic vaccination of dogs against rabies, and experimental data are reported in confirmation of the excellent results claimed by the Japanese investigators for this method.

The vaccination consists of a single injection of a large dose of phenolized fixed virus prepared as follows: The brain and spinal cord of a rabbit in which rabies had developed in 7 days following the injection of virus are ground, and to the material is added four times its volume of a solution of 60 parts of glycerol in 40 parts of water containing 1.25 per cent of phenol. This vaccine is stored at room temperature of from 18 to 22° C. for two weeks, or in the ice box for 30 days, before being used. For grown animals one injection of 5 cc. per 15 kg. body weight in one-fifth dilution is given, and for puppies of 4.5 kg. or less body weight one-half this dose.

It is stated that the use of this vaccine in two prefectures in Japan has already resulted in a 75 per cent reduction in the number of cases of rabies, the disease occurring only in dogs which were not immunized.

To test the value of this method of immunization six dogs were vaccinated in the above manner and 25 days later were injected with from 0.05 to 1 cc. of street virus, three unvaccinated controls being injected at the same time. All six of the vaccinated dogs remained well, while the three controls developed fatal cases of rabies in from 15 to 17 days.

This method of protective vaccination is considered to offer the possibility of eventually eradicating the disease.

The preparation of antirinderpest serum, using animals of moderate susceptibility as virus producers.--I, Buffaloes, W. A. POOL and T. M. POYLE (*Agri. Research Inst., Pusa, Bul.* 129 (1922), pp. 43, figs. 3).--It has been found possible to prepare a potent antirinderpest serum by the use as virus producers of buffaloes having only a moderate susceptibility to the disease. The antigen prepared by repeated transfer did not lose its potency after as many as 34 subpassages.

¹ Kitasato Arch. Expt. Med. [Tokyo], 4 (1921), No. 2, pp. 89-108.

Vaccination of cattle against rinderpest, E. NICOLAS and P. RINJARD (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1428, 1429).—The authors are of the opinion that if larger amounts of serum than are usually given are used in the simultaneous method of immunization against rinderpest an immunity will be established without external symptoms of the disease, and consequently with less danger to the herd.

Review of literature on tuberculosis appearing during the year 1921 (*Rev. Hyg.*, 44 (1922), No. 4, pp. 338-348).—Literature, mostly from French sources, on the complement deviation reaction in tuberculosis and on tuberculous sensibilisin is reviewed by L. Nègre and on antituberculous vaccination by A. Boquet.

The intrapalpebral tuberculin test, E. JANUSCHKE (*Tierärztl. Arch.*, 2 (1922), No. 3, Teil B, pp. 41-44).—The intrapalpebral (lid) tuberculin test is recommended as giving the effects of both the subcutaneous and the eye test, in that there is not only a typical local edema but also a thermal reaction and generally a purulent discharge on the eyelid. The method of administering the test is described briefly.

The antigenic properties of tuberculin, E. SELIGMANN and F. KLOPSTOCK (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, Orig., 33 (1922), No. 6, pp. 467-477).—To throw light on the nature of the tuberculin reaction, the authors have attempted to determine whether a specific hypersensitiveness toward tuberculin can be produced in healthy guinea pigs by the injection of old tuberculin. From the experimental evidence reported, the conclusion is drawn that guinea pigs can occasionally, although not regularly, be sensitized toward tuberculin. The sensitization differs from the anaphylactic shock following intravenous reinjection, from the inflammation following cutaneous reinjection, and also from the Arthus phenomenon.

The preparation of tuberculins, A. F. SCHALK (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 2, pp. 162-167).—A brief description is given of methods employed in the preparation of tuberculin at the North Dakota State Serum Institute.

The prevention of tuberculosis in cattle, N. RAW (*Vet. Jour.*, 77 (1921), No. 554, pp. 275-277).—To immunize calves against tuberculosis, the author suggests the use of tubercle bacilli attenuated by repeated transfer, as previously described (E. S. R., 46, p. 280).

Infectious abortion in cattle, III, L. F. RETTGER, G. C. WHITE and L. M. CHAPMAN (*Connecticut Storrs Sta. Bul.* 108 (1921), pp. 59-88).—This continuation of the investigation of contagious abortion in cattle (E. S. R., 43, p. 584) deals chiefly with the possibility of transmission of the disease through infected food. Two experiments arranged to throw light on this question are reported.

In the first, 8 cows, ranging from 2 to 12 years of age and giving negative agglutination and fixation tests for contagious abortion, were subjected to oral administration of *Bacterium abortus* in the form of water or physiological salt suspensions of several strains of the organism mixed with bran and administered in capsules. Two of the cows were each given daily for 14 days one capsule containing 5 cc. of a heavy mixed suspension of the organism, three received the same treatment on alternating days for 28 days, and three once a week for 14 weeks. The cows were kept under constant observation for six months, during which time serological tests were made nine times at close intervals. Breeding data on these animals were also recorded. None of the animals in this test became confirmed reactors. The complement fixation tests were negative throughout and the agglutination tests, with two exceptions,

either negative or doubtful. There were no abortions during or immediately following the experimental period.

Similar results were obtained when the experiment was repeated on a much larger scale and over a much longer period. Twenty nonreacting heifers were used in this experiment, 10 serving as controls. All were kept in the same barn, the two lots being separated by a high wooden partition. The same care and treatment were given both lots with the exception of the oral administration of the *B. abortus* cultures, which were given at first in capsules and later in suspension in milk. No animal receiving the cultures became infected or aborted. That the organisms used in these tests were virulent was shown by positive reactions and actual infection brought about in most of the animals in the two groups following subsequent subcutaneous and intraurethral injection and vulvar application of the abortion organisms.

Attempts were also made to bring about infection by intravaginal injection of suspensions of *B. abortus*. Three of the 7 animals receiving such injections eventually became confirmed reactors, one of which aborted and another calved prematurely. The remaining 4 heifers apparently completely resisted the infection and gave some evidence of being immune, but became reactors on subsequent intraurethral injection.

In considering the question of the infection of the bull, it is stated that considerable evidence is at hand to show that there is a distinct correlation between progressive infection in the females of the herd and the relative number of bulls which become reactors after they enter into the service period. Of a total of 59 bulls in 8 herds tested, 12 proved to be reactors. Permanent reactions to the blood test followed in one case out of five in which bacterial suspensions were injected into the sheath of bull calves.

"The results thus far obtained point to the two following necessary expedients for the elimination of infectious abortion from a herd: (1) Disinfection of the sheath of the male and of the vulva and surrounding parts of the female before and after service; and (2) general dairy barn sanitation, including in particular the isolation and disinfection of aborting and discharging infected heifers and cows, removal and safe destruction or burial of aborted fetuses and afterbirths, and the promulgation of the ordinary rules of hygiene in and around the dairy barn."

Bovine infectious abortion, M. F. BARNES (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 2, pp. 133-144).—A brief history is given of bovine abortion in Pennsylvania, and of attempts at its control.

The cultivation of the virus of lung sickness (pleuropneumonia) of cattle, C. GISE (*Berlin. Tierarztl. Wchschr.*, 38 (1922), No. 3, pp. 25-28).—The author recommends the addition of 8 per cent of horse serum to Martin's bouillon or beef bouillon used as a culture medium for the cultivation of the antigen for the complement deviation test for contagious pleuropneumonia (*E. S. R.*, 46, p. 883.)

Botulism in its relation to antihog-cholera serum and hog-cholera virus, E. A. CAHILL, H. W. JAKEMAN, and T. W. MUNCE (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 6, pp. 702-716).—Contrary to the results reported by Graham (*E. S. R.*, 46, p. 378), the authors have been unable to detect the presence of *Bacillus botulinus* or its toxin in 134 samples of antihog-cholera serum and hog-cholera virus as determined by anaerobic growth on meat medium and by inoculation of guinea pigs and white mice. In addition to these tests, the protocols of which are given, it is reported that 1,700 similar tests previously conducted gave consistently negative results.

Further experiments to determine whether serum or virus artificially contaminated with *B. botulinus* might contain a preformed toxin capable of causing botulism, or whether swine inoculated with a spore-serum mixture would develop botulism, gave results indicating that *B. botulinus* is incapable of producing toxin in phenolized antihog-cholera serum and virus, but that the spores are capable of forming a strong toxin in unphenolized defibrinated hog blood. In such cases the odor said to be characteristic of *B. botulinus* toxin is most marked, while in phenolized serum or virus no odor was observed.

Guinea pigs inoculated with antihog-cholera serum containing *B. botulinus* but no toxin died several days following the inoculation, indicating that the toxin was formed in the body as previously demonstrated by Orr (E. S. R., 46, p. 467). Similar results were not obtained with swine, no sickness following the injection of approximately 4 billion spores.

RURAL ENGINEERING.

The Arkansas River flood of June 3-5, 1921. R. FOLLANSBEE and E. E. JONES (*U. S. Geol. Survey, Water-Supply Paper 487 (1922), pp. 44, pls. 6, fig. 1*).—The results of an examination made of all the streams within the area affected by the flood in the Arkansas River of June 3-5, 1921, to procure data on maximum run-off in the foothill region and the effect of this tributary run-off upon the main flood are reported and discussed.

Stresses in concrete drain tile. J. A. WISE (*Engin. and Contract., 57 (1922), No. 19, pp. 441, 442, figs. 2*).—In a contribution from the Bureau of Public Roads, U. S. D. A., a mathematical analysis is presented of the stresses in concrete drain tile under load in a trench. The analysis indicates that the safe load per linear foot on such tile is greater than that allowed by the specifications of the American Society of Testing Materials.

Report on the design, construction, and life of metal flumes. J. HINDS (*Reclam. Rec. [U. S.], 13 (1922), No. 4, pp. 65-72*).—The results of a questionnaire on the design, construction, and life of metal flumes at six projects of the U. S. Reclamation Service are tabulated and discussed.

The data indicate that metal sheets galvanized, manufactured, installed, and maintained as were the earlier metal flumes will last under average conditions from 10 to 12 years. No data are available as to the weight of galvanizing on these old sheets, but they probably carried not more than 1.5 oz. per square foot. The later flumes with heavier coatings and with more careful painting and maintenance may be expected to show a materially longer life.

There appears to be no appreciable difference in the lasting qualities of the various brands of iron and steel used for flume sheets. Rough interior flumes appear to deteriorate more rapidly than smooth flumes due to disturbances at joints. Light silt in suspension does not in all cases seriously erode the flume sheets, but heavier particles may destroy the sheets in a comparatively short time. Careful consideration should be given in designing flumes to possible future increase in canal capacity and to the size of washers and shoes.

The present type of concrete footing is generally satisfactory. The size of footing should be increased for soft soils, and special care should be taken to make footings in seeped locations resistant to alkali. Trestle timbers should be of ample size and should be protected with paint or creosote. Posts are liable to rot at the bottom.

Sheets should be painted before the galvanizing is destroyed with a coat of water-gas tar, followed by one or two coats of coal tar, and a coat of coal tar should thereafter be permanently maintained on the sheets by repainting at intervals of from one to three years.

Design, construction, and use of metal flumes, J. HINDS (*Engin. News-Rec.*, 88 (1922), No. 21, pp. 854-861, figs. 11).—In a contribution from the U. S. Reclamation Service, a detailed discussion is given of semicircular flumes from the standpoint of types, supports, stresses, expansion, end structures, and surface coverings. Tabular data are included on sag in metal flumes and experimental values of Kutter's n in semicircular flumes, and graphic data showing discharges with n equal to 0.012 and critical velocities and freeboards for critical depths in semicircular flumes.

Transmission of pressure through solids and soils and the related engineering phenomena, G. PAASWELL (*Amer. Soc. Civil Engin. Proc.*, 48 (1922), No. 5, pp. 1075-1089, figs. 8).—A mathematical analysis of the subject is given. It is shown that in a restricted sense the so-called rule of thumb methods of assumed stress paths at present used hold true, but that danger zones exist which are not indicated by these empiric methods which may affect the safety of structures sustained by soils. The analysis deals with both ordinary soils and rock soils and concrete materials. It is shown that all coherent granular materials, including concrete and rock, have like failure surfaces.

Strength of materials, A. MORLEY (*London and New York: Longmans, Green & Co.*, 1920, pp. IX+555, figs. 268).—This book is written for both engineering students and practicing engineers. In many sections well-established lines have been followed, but numerous special features are presented. For instance the different theories of elastic strength are explained, and subsequently throughout the book the different formulas to which they lead in cases of compound stress are pointed out. Considerable use is made of the method of finding beam deflections from the moment of the area of the bending moment diagram. Other subjects treated which have hitherto received scant attention include the strength of rotating disks and cylinders, the bending of curved bars with applications to hooks, rings, and links, the strength of unstayed flat plates, and the stresses and instability arising from certain speeds of running machinery. Other subjects dealt with are mechanical properties of metals; resilience and fluctuating stress; theory of bending; stresses in beams; built-in and continuous beams; secondary effects of bending; direct and bending stresses; twisting; testing machines, apparatus, and methods; special tests; and special materials.

Industrial timber research abroad and in South Africa, I-VII, N. B. ECKBO (*So. African Jour. Indus.*, 4 (1921), Nos. 6, pp. 534-539; 8, pp. 737-744; 9, pp. 778-787; 10, pp. 847-854; 11, pp. 896-904; 5 (1922), No. 2, pp. 57-65; 3, pp. 116-121, figs. 31).—The first article of this series deals with forest research institutions in the United States, India, Canada, Australia, and England. The other numbers are devoted to data on processes and apparatus used in the seasoning of South African woods, together with tests of the physical and mechanical properties of certain woods after seasoning.

In connection with the preparation of practicable seasoning schedules, it has been found that woods of varying dimensions should be given individual treatment according to size. In general, wood is considered to be seasoned when it does not shrink, warp, or split in use except under the influence of seasonal changes. If wood is uniformly dry and free from stresses, the two principal causes for shrinkage, warping, and splitting are considered to have been removed. The experiments have indicated that wood seasoned to 7 per cent moisture content by weight is fairly certain to give satisfaction.

The seasoning of South African woods, N. B. ECKBO (*Union So. Africa, Forest Dept. Bul.* 5 (1922), pp. 43, figs. 21).—This is a reprint of that part of the above article relating to seasoning of South African woods.

When preservative treatment of wood is an economy (*Engin. and Contract.*, 57 (1922), No. 20, p. 466).—In a contribution from the Forest Service, U. S. D. A., tabular data are given to enable the timber user to compute the relative annual cost of maintaining treated and untreated timbers, provided he knows the average life and cost in place of each.

The 1915–1916 test paint fence, W. T. PEARCE, E. V. LADD, and H. A. KELLY (*N. Dak. Agr. Col. Regulatory Div. Spec. Bul., n. ser., 1* (1922), No. 4, pp. 91, figs. 6).—Studies conducted in connection with the paint regulatory work at the North Dakota Agricultural College are reported, continuing previous work (*E. S. R.*, 33, p. 90).

Fences for testing paint were constructed in 1915 and 1916, each section of which consists of three panels of six clapboards each. Two paint tests were made on each panel. The fences face east and west and are made of a fair grade of white pine. All of the paints tested were white in color. The pigments used were ground in the mills in the experimental paint laboratory of the college. Raw linseed oil was used in all cases except those in which oil tests were conducted when the pigment was ground in the oil that was to be tested. The oils used in the tests were raw linseed, bleached menhaden, raw China wood, filtered perilla, raw soy bean, raw cottonseed, and raw corn oils.

In pigment tests it was found that the replacement of basic carbonate white lead by zinc oxid caused no very bad effects up to 20 per cent. The 80 per cent replacement caused bad cracking within five years and left a poor repainting surface. The still larger replacement of basic carbonate by zinc oxid caused bad cracking and scaling within three years. A similar replacement of basic sulphate white lead by zinc oxid produced about the same effect when failures caused by poor wood were eliminated. Mixtures of basic carbonate white lead and basic sulphate white lead gave fully as satisfactory results as the pigments used separately. The substitution of as little as 15 per cent of any of the inerts in paints containing single lead pigments and mixtures of lead and zinc pigments caused very bad scaling and produced a surface wholly unfit for repainting. No differences were found in the comparative values of red lead, basic carbonate white lead, and basic sulphate white lead for priming coats for typical single and mixed pigment paints. No bad effects were noted on basic carbonate white lead when lead acetate was present in amounts less than 5 per cent.

In oil tests no differences were found in the behavior of raw and treated linseed oils sufficient to warrant the drawing of any preferential conclusions. In the cases where different vegetable oils were used, raw linseed, filtered perilla, raw China wood, and menhaden oils gave good service, soy bean oil gave fair service, and corn and cottonseed oils poor service.

In the tests of driers only very slight differences were noted, and no conclusions are drawn.

Data are also presented on reduction tests in which various reductions were made for the priming coat using typical single and mixed pigment paints. No conclusions are drawn.

Heat transmission by radiation, conduction, and convection, R. ROYDS (*New York: D. Van Nostrand Co., 1921, pp. VIII+238, pls. 3, figs. 100*).—This is a very technical exposition of the fundamental principles of the radiation and conduction of heat, convection and resistance to the flow of fluids, and the transmission of heat by convection. Tables of working data are included.

Heat transmission in boilers, condensers, and evaporators, R. ROYDS (*New York: D. Van Nostrand Co., 1921, pp. VIII+302, pls. 3, figs. 133*).—This book apparently supplements that noted above. The first chapter is devoted

to experiments on boilers and to comparisons with the results obtained from a small apparatus mentioned in the above work, as well as to examples of the application of the laws of heat transmission to design. The second chapter summarizes and discusses experiments on the condensation of steam and rate of heat transmission in surface condensers and coolers. The third chapter deals with the transmission of heat in evaporators.

Gas made by carbonizing straw, H. E. ROETHE (*Gas Age-Rec.*, 49 (1922), No. 3, pp. 75, 76, figs. 2).—In a contribution from the Bureau of Chemistry, U. S. D. A., a description is given of the process and apparatus used at the Arlington, Va., experiment station for the production of combustible gas by the destructive distillation of straw and similar materials. The apparatus consists of a cylindrical sheet steel retort, accommodating about 200 lbs. of un-baled straw, a cylindrical sheet steel scrubber, and a steel water chamber gasometer for storage of about 100 cu. ft. capacity.

It has been found that gas begins to come off when a temperature of about 200° C. (392° F.) is reached, with a maximum production between temperatures of 500 and 600° C. After the initial production of gas the carbonizing process can be continued, using as fuel a portion of the gas already generated. It is stated that 1 ton of sun-dried wheat straw produces approximately 10,000 cu. ft. of purified gas, from 600 to 650 lbs. of carbon residue, and about 10 gal. of tarry liquid. The gas has a calorific value of about 400 B. t. u. per cubic foot, burns with a blue flame, and has a slight odor. The combustible constituents of the gas are carbon monoxid, methane, and hydrogen.

Wiring for light and power, T. CROFT (*New York and London: McGraw-Hill Book Co., Inc.*, 1921, 3. ed., pp. [21+81-842+1]-XIV+465, figs. 426).—This is the third revised and enlarged edition of this handbook. It contains sections on generators, motors, switchboards, etc.; inside and outside work—all systems and voltages; constant-current systems, principally series; lighting; constant-potential systems, general rules, all voltages; constant-potential systems, extra high high, and low-potential systems; fittings and materials; insulated wires, cables, and cords; miscellaneous; and marine work.

Power farming and subsoiling demonstration (*Impl. and Mach. Rev.*, 48 (1922), No. 565, pp. 69-71, figs. 6).—The results of a demonstration of a number of new implements for plowing and subsoiling are briefly presented. The implements demonstrated included subsoilers, mole drain plows, pitch pole drags, self-lifting harrows and cultivators, roller packers, and a tree puller.

A small grain nursery thresher, O. F. JENSEN and M. E. OLSON (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 4, pp. 110-112, fig. 1).—A small thresher in described and diagrammatically illustrated. This was designed at the Iowa Experiment Station to avoid the labor of threshing by hand a large number of grain samples from yard square or similar areas used in obtaining plat yields from outlying fertility and crop production experiments.

Housing of animals.—IV, **Animal and poultry yards, dog kennels, bee-hives, and silkworm nurseries**, M. RINGELMANN (*Logements des Animaux—IV, Basses-Cours, Chenils, Ruchers, Magnaneries. Paris: Libr. Agr. Maison Rustique*, 1922, pp. 160, figs. 114).—This is the fourth article of this series (*E. S. R.*, 45, p. 590). It deals with the planning and construction of animal and poultry yards, dog kennels, beehives, and silkworm nurseries.

Pisé de terre, P. B. AIRD (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 4, pp. 353-360, figs. 5).—Practical information on the use of pisé de terre as a material for use in the construction of buildings is given, together with diagrammatic illustrations showing details of the forms and tools used and methods of construction.

Concrete stock-watering tanks (*Cement and Engin. News*, 34 (1922), No. 4, pp. 21, 22, fig. 1).—Information and tabular data showing the dimensions and materials required in the construction of stock-watering tanks are given and methods of construction briefly described.

The trench silo, G. H. HURRON (*Farmer's Advocate and Home Jour.*, 57 (1922), No. 1527, pp. 261, 262, fig. 1).—A description is given of a trench silo, which should be located on some well-drained site and consists of an excavation of about 8 ft. deep, 16 ft. wide, and as long as desired. The silage is merely packed in this hole and covered with straw. Such silos are said to work well in Canada.

The northwest station poultry house, C. G. SELVIG (*Minnesota Sta., Crookston Substa. Rpt.* 1920, pp. 74, 75).—The experimental poultry house at the station is briefly described and a bill of material given.

Drainage and sanitation, E. H. BLAKE (*London: R. T. Batsford, Ltd.*, 1920, 2. ed., pp. XII+519, figs. 379).—This is the second edition of this book, the purpose of which is to give a practical exposition of the conditions vital to healthy buildings, their surroundings and construction, and their ventilation, heating, lighting, water, and waste services. Considerable space is devoted to water supplies and sewage purification and disposal.

RURAL ECONOMICS AND SOCIOLOGY.

Land settlement, J. D. BLACK (*Minnesota Sta. Rpt.* 1921, p. 40).—Data taken on three settlement projects in Minnesota in the summer of 1919 are briefly reported.

The 542 settlers visited had made an increase per year in net worth of \$630. They had been living on their holdings an average of 4.7 years. It is indicated here that a little more than three years are required for the average settler to become self-sufficing. Of the receipts the largest item was labor off farm, with timber products next. By the third year receipts from livestock products were more than equal to receipts from timber products.

Who gets the unearned increment? H. A. WALLACE (*Wallaces' Farmer*, 47 (1922), No. 20, pp. 637, 645, fig. 1).—Statistics are charted illustrating the value of an acre of Iowa corn land from 1892 to 1922 and the division of it between land and labor. Labor charges as calculated here seem to have been stable until 1900, increasing slightly until 1916. With phenomenal advances in the price of Iowa farm land between 1916 and 1920, land's share per acre advanced over that of labor, though at the beginning of 1920 it dropped and that of labor increased until 1921. Thereafter it absorbed practically everything, leaving nothing as land's share. It is deemed more desirable to have any new profits which may materialize absorbed by labor rather than by higher stock or land prices.

Second Ouyen farm competition, H. A. MULLETT (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 4, pp. 193-206, figs. 12).—The cropping systems, improvements, farm layouts, and conveniences found on farms winning in a second competition similar to that previously noted (E. S. R., 42, p. 593) are reported on.

Cost accounting investigations on Minnesota farms, G. A. POND, M. MARSHALL, and C. PRCHAL (*Minnesota Sta. Rpt.* 1921, pp. 48, 49).—Detailed cost accounting studies conducted on a number of farms in Steele and Cottonwood Counties in 1920 are briefly summarized.

The Eight-hour Day Act and its application to agriculture in Czechoslovakia (*Geneva: Internatl. Labor Off.*, 1921, pp. V+96).—This report embodies results of investigations of the workings of this act on several agricultural

estates in Czechoslovakia and the evidence of representatives of landowners, agricultural workers, and the Government. It contains a detailed examination of the methods used for applying the act, describes its results, and discusses the social and economic changes to which it has so far given rise.

At first the act appears to have caused some confusion and to have created a certain tension in the relations between employers and workers. This was brought to an end, however, by collective agreements. Its application was found to be easier on very large farms, the small and average-sized farms having suffered from its application. The workers appeared to have had more spare time than before its passage and to have spent their leisure in additional work or on trade-union activities. It seemed not to have affected the number of strikes on the whole. It is shown that a rigid application of the principle of the 8-hour day is impossible in agriculture.

Official grades for the standardization of Idaho farm products, 1921 ([Boise]: Idaho Dept. Agr., 1921, pp. [54]).—Official grades for fruits, potatoes, hay, and grain are defined, and Bonded Warehouse Act rules and regulations are given.

Report of the commissioner of labor and industries, the director of standards, the commissioner of agriculture, and the director of the division of markets upon the expediency of revising the established legal bushel weights of fruits, vegetables, and other commodities, with recommendations for legislation to establish a more satisfactory basis for retail sales of said commodities, E. L. SWEETSER ET AL. (Boston: Comm. for Revising Established Legal Bushel Weights, 1922, pp. 20).—Actual weights of the measured bushel of various fruits, vegetables etc., are tabulated, representing 658 distinct test weighings and revealing marked variations. A brief history of the establishment of weights and measures is given. It is recommended that all retail sales of fruits and vegetables be made on the basis of avoirdupois weight, and a bill is drawn up to this effect.

Packers and Stockyards Act, 1921 (U. S. Dept. Agr., Off. Sec. Circ. 156 (1922), pp. 35).—General rules and regulations of the Secretary of Agriculture with respect to stockyard owners, market agencies, and dealers, together with the text of the Packers and Stockyards Act, 1921, and extracts from the Federal Trade Commission Act, are set forth here.

The cotton industry in France, R. B. FORRESTER (Manchester, Eng.: Univ. Press, 1921, pp. XIV+142, figs. 10).—This reviews the history of the cotton manufacturing industry in the important centers in France, namely, the Nord, Normandy, the Rhône-Loire, and the Est, setting forth the economic conditions influencing this centralization and social and economic conditions involved with the industry. An extensive bibliography is included.

The outlook for cooperative marketing, E. G. NOURSE (Jour. Farm Econ., 4 (1922), No. 2, pp. 80-88).—Two goals proposed by American cooperators are said to be centralized market control and decentralized business organization for the more efficient standardization, assembling, and market distribution of farm products. The author urges the perfecting of the organization of country shipping and, to a lesser degree quantitatively, of the processes of central market selling on a cooperative basis. Certain marketing schemes held to be overpromoted and to have too ambitious a scope are criticized. Standardization of business practice along professional lines; accurate and adequate record keeping; study of market outlets, price trends, and buyers' preferences; improvement in the product; technical efficiency in handling it; and careful overhead service organization are recommended for the program of future development.

Farmers' cooperative movement in Alberta (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev.*, 14 (1922), No. 5, pp. 204, 205).—Social, educational, and commercial bodies are briefly noted.

The report of the Agricultural Organization Society for the year ended March 31, 1921 (*Agr. Organ. Soc. [London] Rpt.*, 1921, pp. VI+37).—This covers the year's progress of this and affiliated cooperative societies and the allotment and small holdings organization. A statistical summary for 1920 is given.

The cooperative use of agricultural machinery, including power plows, as an aid to modern German agriculture, H. SCHWANECKE (*Deut. Landw. Presse*, 48 (1921), Nos. 60, pp. 444, 445; 61, pp. 452, 453; 62, p. 458; 63, pp. 466, 467).—Statistics, with interpretative notes, are given, showing the cooperative use of agricultural machinery on holdings in various size groups in Germany in 1912-13 and in 1920. Prices of agricultural implements and machinery in recent years are compared with those for earlier periods to show how the marked increases have made necessary such organization among farmers.

The cityward movement, J. G. THOMPSON (*Jour. Farm Econ.*, 4 (1922), No. 2, pp. 65-79).—The author argues for certain beneficial results of the cityward movement, as providing a market for surplus production on the farm, a decline in the death rate due to modern urban health movements, political and constitutional development, and a rise in ethical, moral, and religious standards. The city population of the United States had reached 51.4 per cent of the total in 1920. The cityward trend in various States of the United States and in foreign countries is discussed and explained. How far the movement should go is held to depend in a large degree upon the extent to which a country is to be self-sufficing in respect to food supplies. The proper sphere of human intervention should lie in improving country life, shortening the hours of labor on the farm, developing cooperation and education, and carrying out an equitable tariff policy.

Proceedings of the Rural Life Conference (*Va. Univ. Rec., Ext. Ser.*, 6 (1921), No. 2, pp. 106).—The program at the Virginia Rural Life Conference, held May 17 and 18, 1921, includes a paper on *The Transition in Rural Life from the Family Régime to the Community Régime*, by C. J. Galpin, in which emphasis is placed upon the woman's rôle of socializer of country life and her awakening to the possibilities of community development; a report on rural schools in Virginia, with suggestions for their improvement; a summary of community organization and cooperation of agencies; and papers on *Improving Health in Rural Virginia*, by C. D. Hart, and on *Rural Social Problems—a Summary*, by E. C. Lindeman; together with abstracts of other addresses and numerous committee reports.

History of fifty years in Illinois State Grange, J. E. YATES ([*Mascoutah*]: *Ill. State Grange*, 1921, pp. 8).—Brief notes regarding the annual sessions of this organization are brought together.

The story of the Agricultural Club, 1918-1921, R. H. REW (*London: P. S. King & Son, Ltd.*, 1922, pp. XV+205, pls. 4).—This is a brief account of the organization of this club, made up of the members of the Agricultural Wages Board, district wages committees, and officers on the board's staff, as well as others elected by ballot. A condensed record of addresses given before its meetings on the subjects of agricultural economics, rural education, agrarian politics, nationalization of the land, ownership and tenancy, rural housing, the worker's share in agriculture, and other rural, social, and economic problems in Great Britain is compiled.

The progress of British agriculture, R. H. REW (*Jour. Roy. Statis. Soc.*, n. ser., 85 (1921), No. 1, pp. 1-19).—This is a review of statistics of agricultural production in Great Britain since about 1866 up to recent years.

It appears that the data available indicate the production of a larger quantity of food at the outbreak of the war than at any previous period. There was a marked reduction in the production of meat and milk during the war with an increase in the amount of cereal food and potatoes. It is held that the total output of food will be maintained in the future although it may be of a different kind, with potatoes and pigs, milk and meat, and fruit and vegetables produced in the place of wheat.

The position of Czechoslovakia in world production, K. FIEDLER (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 38, pp. 553-556).—Tabulations are given of the yields of the principal grains and the numbers of live stock in about 23 leading countries of the world in recent years, indicating the position of Czechoslovakia as fourteenth in total production and yield per acre of grain; eleventh in numbers of cattle, swine, and sheep; fourteenth in per capita production of grain; and fifth in the number of live stock per unit of agricultural land.

Weather, Crops, and Markets (U. S. Dept. Agr., *Weather, Crops, and Markets*, 1 (1922), Nos. 17, pp. 353-376, figs. 4; 18, pp. 377-392, figs. 4; 19, pp. 393-424, figs. 4; 20, pp. 425-440, figs. 2).—The usual weekly reviews of weather conditions are given in these numbers, with temperature and precipitation charts, also tabulated reports and special articles on the receipts and prices of important classes of agricultural products and particular commodities, local or outstanding market situations, and foreign markets. No. 17 contains summarized weather data for March. No. 19 contains the monthly crop report for May, showing the United States crop summary; estimated crop conditions May 1, 1922, by States; and the estimated farm value of important products. April 15 and May 1, 1921 and 1922; also averages of prices received by producers, April 15 and May 1, 1922. Tabulated reports are made on the condition of farm animals, May 1, and estimated losses during the year ended April 30, by States, as well as of losses of farm animals, 1888 to 1922.

Labor, prices, and supplies (*Natl. Farmers' Union [London] Yearbook*, 1922, pp. 303-310).—Statistics for recent years, with comparisons, are assembled, setting forth briefly minimum wage rates in agriculture, the cost of living, changes in prices of agricultural produce in England and Wales, yields of principal crops, and numbers of live stock, also imports and exports of foodstuffs into the United Kingdom and the average world supplies of bread and meat.

[Agricultural and live-stock statistics for Finland] (*Statist. Årsbok Finland*, n. ser., 19 (1921), pp. 92-105).—Statistics for 1921 are added to the series previously noted (E. S. R., 46, p. 93).

Area, classification of area, area under irrigation, area under crops, live stock, land revenue assessment, and harvest prices in British India, D. N. GHOSH (*India Agr. Statis.*, 36 (1919-20), 1, pp. [6]+IX+380, pls. 6).—These statistics continue information previously noted (E. S. R., 45, p. 898).

Estimates of area and yield of principal crops in India, 1920-21, D. N. GHOSH (*India Dept. Statis., Est. Area and Yield Princ. Crops India, 1920-21*, pp. [2]+38, pl. 1).—These tabulations continue information previously noted (E. S. R., 45, p. 597).

AGRICULTURAL EDUCATION.

Fifth annual report to Congress of the Federal Board for Vocational Education, 1921 (*Fed. Bd. Vocat. Ed. Ann. Rpt.*, 5 (1921), pp. 462, pls. 2, figs. 3).—This report deals with the year's progress in the evolution of cooperative States relations services and the vocational rehabilitation of civilian disabled and disabled soldiers, sailors, and marines.

The need of making careful surveys of communities with respect to the advisability of establishing agricultural schools or departments has been recognized. Part-time and evening class work has received a marked impetus, and farmers' organizations are beginning to demand that more agriculture on a vocational basis be taught in all-day, part-time, and evening classes. Vocational work has been established in a larger number of rural communities, and this has in itself stimulated consolidation. Prevocational agriculture is beginning to be introduced under the direction of agricultural teachers in that they are directing the teaching and supervising of home practice work. A general improvement in supervision is reported from all sections of the country. Professional improvement conferences were organized and conducted on an entirely different basis in most States from that of previous years.

Four types of vocational instruction are said to be under way namely, the all-day school, composed of pupils who are enrolled in the regular public schools and who are taking not less than 90 minutes of actual instruction in agriculture at the school and not less than an average of 90 minutes per day of supervised practical work; the short unit course school, in which public-school pupils take a minimum of 90 minutes a week in some short unit course of instruction in technical agriculture and do not less than six months' directed or supervised practice in agriculture; the part-time schools, for those who have entered upon the work of the farm and return to pursue short unit courses in technical agriculture and in civic and vocational subjects and who do at least six months' directed or supervised practice in agriculture; and the evening school, for persons over 16 years of age who are taking short unit courses and at least six months' directed or supervised practice work in agriculture.

There was a total increase in enrollment in day schools of 23 per cent over the previous year, with two States reporting decreases and one an increase of 59 per cent. The State of Pennsylvania has developed the short unit course type of vocational education in connection with its township high schools. During the year 1920-21 there were 34 States that did part-time work. The number of schools organized for the year was 468, an increase of 274 over the previous year. The enrollment for the year was 7,043, an increase of 3,136. A notable increase in the number of evening classes and enrollment is reported for all regions. Teacher-training classes enrolled 2,936, having a teacher-training staff of 278, as against an enrollment of 2,310, with a teacher-training staff of 293, in 1919-20.

A portion of the report of a committee, appointed by the National Society for Vocational Education and the department of rural education of the National Education Association to consider the relationship between the extension and vocational education forces in the various States, is presented along the lines previously noted (*E. S. R.*, 45, p. 710).

The most significant developments in the field of home economics education for the year 1920-21 are reported as (1) the expansion of the work to include a program which reaches a larger number of girls and women who are out of school, (2) an increase in the number of full-time supervisors employed as

members of the staff for State boards for vocational education, (3) special emphasis on the promotion of home projects as a part of the program for the all-day school, (4) developments in teacher training both within the institutions designated and through the establishment of local centers to reach experienced women with professional training, (5) special work in the promotion of negro education, and (6) greater opportunities for discussion of questions of administration and policy through regional conferences.

About 50 per cent more all-day schools are reported for 1920-21. Of the 782 schools with 1,184 teachers and 26,125 pupils, 19 schools were wholly vocational, while others were departments in elementary and high schools. Thirty-two were in elementary schools, and 13 of these were negro schools. Ten States required home project work as a part of the vocational program and 107 12-months teachers were employed, 3 States requiring all of their vocational teachers to be employed for the full year. Two hundred and ninety-seven evening-school centers are reported. Seventy-three institutions were preparing teachers for home economics, 13 of which were for teachers in negro schools.

A summary of progress by the States in the several fields of vocational education is shown.

Agricultural education in Canada, J. B. REYNOLDS (*Agr. Gaz. Canada*, 8 (1921), Nos. 5, pp. 553-557; 6, pp. 661-665).—The aims and methods of teaching agriculture in public schools, high schools, agricultural schools, and agricultural colleges of Canada are reviewed here.

Wheat: A geography plan for sixth grade, O. G. CARR (*Jour. Rural Ed.*, 1 (1922), No. 7, pp. 297-301).—Six lesson plans are drawn up, exercises are suggested, and a number of correlating subjects which may be taught in connection with the wheat problem are outlined.

MISCELLANEOUS.

Work and expenditures of the agricultural experiment stations, 1920, E. W. ALLEN, E. R. FLINT, and J. I. SCHTITE (*U. S. Dept. Agr. [Rpt.] Work and Expenditures Agr. Expt. Stas., 1920, pp. 94*).—This report consists mainly of a discussion of the activities of the stations and the use made by them of the funds granted by the Federal Government under the Hatch and Adams Acts, including the usual detailed statistics compiled from official sources as to the organization, revenues, additions to equipment, and expenditures of the stations. An editorial discussion is given on page 301 of this issue.

A classified list of projects carried on by the agricultural experiment stations, 1921, E. R. FLINT (*U. S. Dept. Agr., States Relat. Serv. [Pamphlet], 1922, pp. 2+VIII+325*).—This is a revision, in multigraphed form, of the list previously noted (*E. S. R.*, 46, p. 207), and is discussed editorially on page 306 of this issue.

Twenty-ninth Annual Report of Minnesota Station, 1921, R. W. THATCHER ET AL. (*Minnesota Sta. Rpt. 1921, pp. 117*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, and reports of the director, heads of divisions, and the various substations. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

Report of Northwest Experiment Station, Crookston, 1920, C. G. SELVIG ET AL. (*Minnesota Sta., Crookston Substa. Rpt. 1920, pp. 114, figs. 20*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

NOTES.

California University.—C. B. Samuels has been appointed to a fellowship on the study of sulphur in relation to alkali established at the university through the National Research Council.

The university has received an offer from the California Farm Bureau Federation to establish a fellowship of \$750 per annum in the College of Agriculture to be known as the W. H. Heileman Memorial Scholarship in Agriculture. This fellowship is to be for the investigation of economic problems in agriculture, for for the current year will deal with problems of distributing and marketing milk.

A contribution of \$250 has been made by one of the grand lodges of the Independent Order of B'nai B'rith toward the establishment of a scholarship in the College of Agriculture in memory of the late David Lubin.

Georgia College.—A. M. Thornton resigned as editor June 1, and has been succeeded by the assistant editor, C. W. Summerour.

Illinois University and Station.—W. F. Handschin, connected with the university since 1911 and for several years vice director of agricultural extension and head of the department of farm organization and farm management, died August 1. Professor Handschin was born in 1880 on a farm near Calumetville, Wis., and was graduated from the University of Illinois in 1913. He had previously served as principal of the county school of agriculture at Marinette, Wis., from 1907 to 1908 and as instructor and assistant professor of animal husbandry at the University of Minnesota from 1908 to 1911.

Iowa College.—It is expected to begin construction on the new library building this fall. A sheep barn is under construction, and a brick laboratory building has been completed at the poultry farm at a cost of about \$18,000. The new animal husbandry farm of 180 acres purchased about a year ago has been improved and partially equipped, and two additional tracts aggregating 90 acres have been recently purchased for use in the expansion of various lines of agricultural work.

Fred C. Werkenthin, assistant professor of botany, died June 13, aged 32 years. He was a graduate of the University of Texas and had held various botanical positions at the Texas, New Mexico, and New Hampshire Colleges.

Massachusetts College and Station.—The old chemistry building was completely destroyed by fire September 6, causing a loss of about \$25,000. The building was a large frame structure erected in 1867. It was among the first buildings to be constructed on the college grounds, and in the early days of the institution served as chapel and drill hall as well as for classroom and laboratory purposes. Of late years it had been used mainly by the college department of chemistry. The departmental chemical library and some equipment was saved, but several thousand dollars worth of apparatus and equipment was consumed. Ground had been broken some weeks earlier for a new laboratory building to cost about \$300,000, but this structure can not be completed before next fall. Announcement has been made, however, that all courses scheduled will be given.

The feature of the season's work at the Cranberry Substation has been the organization of bog foreman schools, using the station plant and personnel but organized under the extension service. These schools have held half-day ses-

sions, scheduled to follow the calendar of insect pest developments, with the specific object of giving the bog foremen a certain basic knowledge regarding the life history of the various insects against which control measures have to be taken.

The department of rural engineering has undertaken comprehensive tests on the relative efficiency of various types of low lift, heavy-volume pumps as used in the flooding and sometimes in the draining of cranberry bogs.

A. L. Dacy has resigned as professor of vegetable gardening to engage in farming. Charles O. Dunbar has been appointed investigator in the department of plant and animal chemistry, Frank J. Kokoski analyst in the control service, John J. Smith collector of blood samples under the poultry disease elimination law, and Miss Mildred Hollis analyst in connection with poultry disease examination work, vice Miss Ann Smith.

Michigan College.—Miss Mary E. Sweeney, dean of home economics has resigned.

Mississippi Station.—G. B. Walker has resigned as vice director of the Delta Substation at Weilenman and has been succeeded by W. E. Ayres, who has been plant breeder. R. N. Lobdell, associate professor of zoology and entomology in the college and assistant entomologist in the station, has been appointed for full-time work on the station staff as zoologist.

Cornell University.—A questionnaire sent out to 467 graduates and 149 nongraduates of the College of Agriculture entering from 1906 to 1910 has recently been summarized with a view to acquiring data as to the occupations of these men after a considerable period beyond graduation. It was found that more than a third of the men were engaged in agricultural production and that 27.82 per cent were actually farming for themselves or serving as farm managers. Of the remainder 4.22 per cent were in the employ of the United States Department of Agriculture or the State experiment stations, 3.28 in other scientific work, 13.34 teaching in agricultural colleges and 5.39 in secondary schools, 6.09 as county agents and county agent leaders, and 14.05 in commercial agricultural work, while only 18.97 per cent were in nonagricultural work. The total number classified as in research, teaching, and scientific work was 114, or 26.7 per cent, including agricultural college teachers in 23 States and 3 foreign countries.

Dr. E. W. Benjamin, professor of poultry husbandry, recently resigned to engage in commercial work as New York manager for a firm of distributors handling the products of all Pacific coast cooperative poultry shipping associations, these shipping a total of about 1,000 carloads annually. H. H. Whetzel, head of the department of plant pathology, has been relieved of executive duties at his own request in order to give his time exclusively to teaching and research. L. M. Massey has been appointed head of the department.

New York State Station.—As a part of the station dairy exhibit at the recent State Fair at Syracuse, samples of three different types of American Cheddar cheeses were offered to all who visited the exhibit and their preferences recorded. Over 2,000 votes were cast, the results indicating that the popular demand is about evenly divided between a mild cheese and one more highly flavored through longer curing before coming on the market.

Dr. R. S. Breed, chief in research (bacteriology), has been granted six months' leave of absence beginning March 1, 1923, for the purpose of special study of bacteriological problems at the Pasteur Institute and of dairy sanitation in France, Denmark, and Holland. Dr. J. S. Joffe has been appointed associate in research (bacteriology) beginning January 1, 1923, vice G. J. Hucker, who has been granted leave of absence for the academic year 1922-23.

for graduate work at Yale University. Miss Catherine S. Oaks, assistant librarian at Wells College, has been appointed assistant editor and librarian, beginning October 15 and succeeding Miss Laura G. Collison, resigned.

F. H. Lathrop, associate professor of entomology and assistant entomologist in the Oregon College and Station, has been appointed to the sulphur fellowship of the Crop Protection Institute, which has been placed under the supervision of this station, and entered upon his new duties September 1.

North Carolina College and Station.—The poultry department has been assigned 14 rooms in the new \$250,000 extension building completed in September. This will provide two classrooms, an educational laboratory, a fattening laboratory, a picking, dissecting, and trussing laboratory, a research laboratory, a seminar room and library, two offices, a work room where students may make egg cases, shipping boxes, etc., an animal room and hospital, a storage room for supplies, and an egg candling room. The candling room is located in the basement and is without windows, being lighted from a rosette of blue bulbs from the ceiling, which will make it possible for the class to find its way about the room and yet not interfere with the operation of the red candling light.

Roy S. Dearstyne has been appointed associate in poultry investigations and pathology in the station. J. E. Ivey, assistant in poultry investigations and pathology, has been transferred to the college poultry department with the rank of assistant professor. W. F. Armstrong has been appointed instructor in the college poultry department.

Pennsylvania Institute of Animal Nutrition.—Dr. E. B. Forbes, formerly of the Ohio Station, has been appointed director.

Clemson College.—Grape Day was observed recently at the college by the farmers of the Piedmont section. The program provided for lectures on grape culture, diseases, etc., a trip through the college vineyard, and the distribution of specimens of the three leading varieties of grapes in the region.

South Dakota Station.—A new line of investigation is to be taken up under the Adams fund on the causes of hemorrhagic septicemia. Dr. Knowlton Redfield, instructor in bacteriology, will have charge of the project.

George Jannsen, assistant in agronomy, resigned September 30 to take up graduate work at the University of Wisconsin.

Virginia Station.—R. C. Moore has been appointed assistant horticulturist, beginning July 31. M. E. Gardner, assistant horticulturist, resigned September 15.

Wyoming University and Station.—Dr. A. G. Crane, principal of the State Normal School at Edinboro, Pa., has been appointed president. F. S. Hultz, assistant professor of animal husbandry at the Pennsylvania College and Station, has been appointed professor of animal husbandry and animal husbandman, vice Dr. F. A. Hays, who has accepted an appointment at the Massachusetts College and Station as research professor of poultry husbandry.

EXPERIMENT STATION RECORD.

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A peculiar interest attaches to the history of the Rothamsted Experimental Station which time can not efface. It is not alone the classic nature of its work or the unparalleled record of continuous experimentation, or the fact that the technique of field experimentation is in very large measure traceable to it. It is in part the novelty and boldness of the original enterprise, the fact that it is the progenitor of all our stations, and that it started and developed as a private enterprise for public benefit, on an estate whose history dates back beyond the discovery of this country. It has been brought very close to American students, investigators and the agricultural public.

Hence any new contribution to the knowledge of its past finds warm welcome. The latest addition is by Edwin Grey, field superintendent, who has completed fifty years of service at the station and at the instance of Doctor Russell, the present director, has embodied his remarkable experience in a volume of entertaining reminiscences. This deals but little with the results of the Rothamsted Station, but is devoted especially to the human side—the succession of workers, the part played by different ones from the central figures down to the humblest aids on the plats or in the laboratory, the chronology of events and anecdotes connected with the life of the station, and the details of methods and practices in common use. The interesting glimpse which this informal account gives of the personnel and of conditions and occurrences could only be supplied by one with such an experience and outlook as his.

Mr. Grey came to the Rothamsted Station in 1872 as a boy of thirteen. He was employed as a “grass picker” to assist with other boys in sorting out the grasses, clovers, and weeds from samples of hay grown on the experimental grass plats. He evidently proved an apt and trustworthy pupil, for soon after that work was finished he was brought back for other duties, and rose through the various stages of the routine staff to his present responsible position. Consequently he has had intimate contact with the various classes of workers at different stages, and with the different kinds of operations. His duties were in part in the laboratory, assisting in routine

work and later having direct charge of the nitrogen determinations for many years, and in part in the field, helping in the semi-technical operations, sampling the soils and crops, taking meteorological observations, attending to the discharge from the drainage systems, and finally having general supervision of the plats. His experience has thus covered an unusually wide range, and as Doctor Russell says in the preface to the book, this with his natural qualities has made him particularly well fitted to prepare such a narrative account of fifty years.

"His genial, friendly nature has privileged him to a more intimate knowledge of his fellow workers than most people ever attain, and as a shrewd observer of men and things he has seen much more than many others could have done even had they had the same opportunities. This he has set down in his own kindly, humorous manner, and from his record nothing has been deleted nor has there been any editorial polishing; the record stands as he wrote it—a faithful account of the men and boys who executed the great work which Lawes and Gilbert planned."

Mr. Grey is now the only remaining member of the staff who worked under Sir John Lawes and Sir Henry Gilbert, except one who came a few months before the latter's death. He is thus a link between the earlier and the more recent epochs. The remarkable memory he exhibits for incident and detail extending over so many years enlivens the account and adds materially to its value.

Naturally one of the especially interesting features of this book is the side lights it throws on the founder and his long-time associate: "Lawes, farseeing but with a keen sense of perspective, laying down the broad outlines; Gilbert, with meticulous care filling in the details, giving equal attention to all of them, naturally also something of a martinet"; Warrington, whose work on nitrification is familiar and who came to this country in 1891 to deliver the first course of lectures under the Lawes trust; and others whose names are familiar. Many of the early workers mentioned are less well known, but are interesting to meet because of the part they played and the way in which they illustrated the system followed in manning the station. There were few scientific workers until comparatively recent years; large dependence was placed on non-technical help. Men and boys from the village were brought in and taught to do their parts with care and precision, and they in turn trained others to follow them.

When Mr. Grey came to the station there was no chemist working in the laboratory. The details were closely supervised by Doctor Gilbert, but the nitrogen determinations, in which the old soda-lime method was used, were made by a man trained by Doctor Pugh, a

former chemist from this country; and other operations were performed by similarly trained helpers. The caretaker, who was likewise the ash burner, did the grinding of samples, prepared soil for analysis, and took the rainfall record, with someone to check his figures.

Similarly in the field, the execution of details was in the hands of trusted employees who had been specially trained to do their part. It is mentioned that a laborer who could hardly read or write, but had been employed on the plats since their beginning in 1843, was remarkable for his attention to the smallest details and was entrusted with sampling the drainage waters from Broadbalk field, indicating the volume of the flow by signs which only he himself knew the meaning of. He became known as the "farm experimental man," and was ultimately succeeded by his son who also died in the service of the station.

The reader cannot fail to be impressed with the care necessary in the selection and training of these helpers whose work was so essential, the inculcation of the idea of responsibility and accuracy, and the fitting of them into the scheme of a great plan. The wonder is that so high a degree of accuracy and efficiency could be attained. It must be attributed to the oversight exercised at every step, the checks which were provided, and the intimate contact which Doctor Gilbert and his immediate associates maintained. The tasks assigned were adapted to the capacity of the individual helpers and the stage to which their training had progressed. We are told that instructions were given almost daily by Doctor Gilbert by dictation, rarely verbally; and after verification these were expected to be carried out to the letter.

Much interest attaches to the details employed in the field experiments which developed into the Rothamsted method. The minute attention given to the preparation of the plats is described, the care in the application of fertilizer to prevent its blowing from one plat to another, the burning of soil to mix with the fertilizer to increase its bulk for sowing, the hand weeding of plats, and the harvesting of crops by scythe and sickle. Bird scarers were employed in the fields at seeding and harvest time, the attempt to find substitutes for them being unsuccessful.

The amount of hand labor required was enormous, and its management must have been difficult for, although plentiful in the early years, it was largely common labor and to quite an extent itinerant. For years root crops and beans were dibbled in. Mangels were lifted or pulled by hand, as many as thirty-six men working at this at times; and the hoeing and weeding of the wheat and barley plats required many laborers, a gang of thirty or more being employed on the Broadbalk field in one year. Mr. Grey comments upon the

tremendous amount of hand labor required to keep the legume plats free of weeds and in good condition, and mentions one laborer who spent nearly his whole time at that work becoming well nigh crazy and berating his monotonous job in talking to himself. Such careful culture has rarely been provided, and is of course to be taken into account in considering the yields, especially those of wheat on the famous Broadbalk plats.

It was the practice to cut the wheat plats with sickles up to the time of Sir John's death. The fields were gleaned by hand by boys, as neither horse nor hand rake was allowed on the fields. This gleaning of the plats required a couple of weeks each year, and called for close supervision to see that the gleanings from different plats were kept separate. Both Sir John and Sir Henry were said to be very reluctant to bring any machinery on to the plats, and this was not done until hand labor began to be scarce. Later manure spreaders were introduced, the self-binder and other modern machinery, including the tractor in recent years.

The taking of samples constituted an important part of the procedure in the field experiments. The care exercised in this was typical of the precautions observed in every branch of the work. The ceremony seems almost to have been regarded as a solemn rite, performed with the precision of a ritual and tended over by Doctor Gilbert. Mr. Grey characterizes it as "really a most momentous business."

Everything it seems was sampled—the roots, the potatoes, the hay, the straw and other crops, as well as soils, drainage waters, and the like. Nitrogen was determined every year in samples from all the experimental plats, at a time when the slow process of the soda-lime combustion method was used. The greatest care was observed to get representative samples. The potatoes, for example, were graded so that four samples were taken from each plat, and chemical analyses were made of both the juice and the pulp of most of them. Incidentally, the soil which fell from the tubers in grading was caught in a canvas and returned to the plat from which it came. Soil sampling, especially the "deep depth sampling," must have been very laborious as iron forms were driven down sometimes to the depth of the twelfth nine inches.

The practice of saving parts of these numerous samples led to the accumulation of enormous numbers, which in time weakened the laboratory building and necessitated the erection of a special sample house. In the early nineties it is mentioned that there were about 41,000 samples of soil, grain, crops, and ashes of crops and animals preserved in bottles. They were regarded as part of the records of the experiments, and on numerous occasions have been returned to for special studies.

The elaborate pains taken in perfecting the technique of these experiments down to the smallest details, supplied the ideals and the foundation for field experimentation. If this refinement was not always rewarded by the high degree of conclusiveness hoped for, it served to show the limitations of field experimentation and its real place in the study of the intricate processes connected with the soil and the response of the plant. One would be ignorant of the purpose such experiments have served to minimize their value, as he would be deficient in the perspective of modern science to rest advance wholly upon work of that type.

But the field results were not looked upon as representing finality. They were merely a part of the inquiry. As far back as 1893, when Sir Henry lectured in this country, he explained that "by far the greater part of the laboratory investigations, whether chemical or botanical, have had for their object the solution of problems suggested by the field and feeding experiments." For a time this laboratory work was quite largely of routine character; later it became itself a method of investigation. The field plats with their long accumulated history grew to be in a sense an experimental museum—a storehouse of problems brought to light at successive stages of investigation. As Mr. Grey says, the range of activity expanded, and "as one problem was investigated other problems opened out."

It is well to remember that the Rothamsted experiments started out to ascertain not only the facts but their meaning. They represented an attempt to break away from the primitive type of science in agriculture which accepted its observations and hypotheses with credulity and without requiring verification of them. Such credulity had given some fantastic and incoherent theories which passed current.

Hence, not only were the utmost pains taken to make the observations reliable, with the attempt to eliminate or check all known or conceivable sources of error, but chemistry and botany and bacteriology and other branches of science were early invoked in the effort to interpret them. Ingenuity was directed to devising hypotheses to explain the facts recorded, and the impartial faculty of verification was applied to them to determine which was right.

This is one of the great lessons of Rathamsted. It is not merely that its field experiments have been continued longer than any other, or give larger basis for generalizations, or have been carried out in such a systematic way; but that there has been progressive effort to crystallize the significance of facts by establishing their true relationship. The station has raised itself on the shoulders of the past, and has thus continued a giant in power and leadership in its field.

A noteworthy feature of the Rothamsted experiments is the concentration of those who were engaged in carrying them forward. It

was their primary and almost exclusive business. True, Sir John was in business in London, only 25 miles distant, and went there quite regularly. But Doctor Gilbert gave his undivided time and thought to these investigations, and this was true of the staff. Mr. Grey tells us that the two collaborators were in constant consultation, either during the day when Sir John was at home or in the evening after his return from business. Aside from his daily visit to the laboratory Sir Henry spent most of his time studying in his home nearby, working evenings with his chief office man until late hours.

This close concentration, the freedom from distraction, and the constant following of the work and results may have been no small factor in accounting for the quality of the Rothamsted work. The condition is well nigh unique. With many station workers time for reflection has frequently been a serious lack.

To read this account which Mr. Grey has given us is to get a deeper insight into the spirit of accuracy, patience, and thoroughness which characterized the Rothamsted experiments. It gives a larger realization of the enterprise, the liberality of the benefactor, and the determination to leave nothing undone which would promote the ends sought. When the size of the force of laboratory workers, clerks, and semi-technical employees, and the large number of laborers engaged in the work of the station is considered, some approximation can be made of the heavy expense involved over a long period of years. One can understand the bewilderment of a workman engaged in building a new mahogany-topped laboratory table who remarked: "I can't make out how they make this bloomin' place pay." It is by far the most conspicuous instance of private philanthropy applied to agricultural research, a great example of devotion to science and to public good.

Rothamsted has been immortalized in song and story as well as in the technical accounts of its accomplishments. It is interesting to read that a former clerk at the station who later became a musician of note composed a hymn which he named Rothamsted, and also the jubilee anthem *All Thy Works Praise Thee*, which he dedicated to the two central figures. The Rothamsted Allotment Club, one of the oldest of its kind in England, established by Sir John for the comfort and enjoyment of the laborers, was described by Charles Dickens in an article on *The Poor Man and His Beer*.

And now Mr. Grey, himself a product of the Rothamsted system with a life of devoted service to it, has contributed another chapter—a remarkable human document which will be of deep interest to those who have not, as well as those who have been, privileged to visit this world-renowned institution.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Adsorption at liquid-vapor and liquid-liquid interfaces and some related phenomena, H. H. KING (*Kansas Sta. Tech. Bul.* 9 (1922), pp. 41, figs. 7).—The investigation described in this publication is part of a general study of the adsorption of the normal paraffin acids and alcohols with chains of from 1 to 16 carbon atoms in length both at the interface water-benzene and that of water-air. The fatty acids include the series from formic to decylic and the alcohols methyl to isoamyl octyl and cetyl. Data are also given on the adsorption curves of several amines and esters as shown by the logarithmic curves of the acids and alcohols.

The alcohols exhibit a greater adsorption than the acids and a constant degree of adsorption through a greater range of concentration change. The alcohols of four and five-carbon atoms reach zero adsorption at the same concentrations as the acids of the same number of carbon atoms, while the alcohols of from one- to three-carbon atoms show adsorption at a lower concentration than the corresponding acids. The curves of the esters in general correspond closely to those of the acids. The adsorption of the three classes of compounds is greater at the surface of water than at the interface between water and an organic solvent, such as benzene or a paraffin.

Freundlich's derivation of Gibbs' equation for calculating adsorption at liquid-liquid and liquid-vapor interfaces and an adsorption formula worked out by A. C. Lund are given in full.

A chemical study of the proteins of the adzuki bean, *Phaseolus angularis*, D. B. JONES, A. J. PINKS, and C. E. F. GERSDORFF (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 103-114).—This contribution from the Bureau of Chemistry, U. S. D. A., continues the chemical studies of the proteins of the various beans previously reported (E. S. R., 44, p. 709) by a similar study of the proteins of the adzuki (*P. angularis*), the nutritive value of which has been noted in another series of studies (E. S. R., 46, p. 564).

The adzuki bean was found to contain about 21.13 per cent of protein ($N \times 6.25$), 16.7 per cent of which is extracted by means of a 5 per cent aqueous NaCl solution. As in the case of the other beans, two globulins are separated from the sodium chloride extract with ammonium sulphate. The percentages of basic amino acids in the α -globulin, as determined by the Van Slyke method were arginin 5.45, histidin 2.25, lysin 8.3, and cystin 1.63. For the β -globulin, by the Van Slyke method and the direct method of Kossel and Patten, the respective percentages were arginin 7 and 5.3, histidin 2.51 and 1.76, lysin 8.41 and 4.18, and cystin (Van Slyke method only) 0.86.

Note on the preparation of mannose, E. P. CLARK (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 1, 2).—The method described differs from that of Horton (E. S. R., 46, p. 612) chiefly in that barium carbonate is used instead of slaked lime for neutralizing the excess sulphuric acid, the treatment of the concentrated sirup with alcohol is omitted, and the sirup before treatment with

glacial acetic acid is concentrated to only 87 or 88 per cent total solids instead of 96 per cent as recommended by Horton. In the final crystallization the sirup is seeded, placed in an ice box overnight for crystallization to start, and is then frozen with an ice-salt mixture and allowed to thaw out slowly. It is stated that a week is generally required for complete crystallization, and that the yield is from 42 to 45 per cent of the treated meal.

Improved method for the preparation of vitamin-activated fuller's earth, A SEIDEL (*Pub. Health Rpts. [U. S.], 37 (1922), No. 14, pp. 801-803*).—The improved method of preparing activated fuller's earth (E. S. R., 35, p. 472) consists in the use in place of autolyzed yeast of the concentrated vitamin extract prepared according to the method of Osborne and Wakeman (E. S. R., 42, p. 814).

Fresh bottom yeast in quantities of 50 or more liters is diluted with an equal volume of water and heated with stirring in a steam-jacketed kettle to 90° C. After about 5 minutes at this temperature, the mixture is cooled to 50° or less and the coagulated protein removed by filtration or by centrifuging in a large Sharples centrifuge. To the clear liquid thus obtained English fuller's earth is added in the proportion of 30 gm. per liter. The mixture is stirred vigorously for one-half hour or longer and then filtered or centrifuged. The activated solid thus obtained is washed several times with water and alcohol and thoroughly dried. As thus prepared it is said to contain approximately 1.5 per cent of nitrogen instead of the 2 per cent or more usually present in the activated solid prepared from autolyzed yeast filtrate, and its content of antineuritic vitamin is about twice as great as that of the product made by the original method.

Chemical investigation of amylases and related enzymes, H. C. SHERMAN (*Carnegie Inst. Wash. Yearbook 20 (1921), pp. 386-388*).—This progress report for 1920 of the investigation previously noted (E. S. R., 45, p. 109) includes a brief discussion of experiments which have been reported in detail from another source (E. S. R., 46, p. 707).

The analysis of products containing sucrose by the neutral double polarization method, C. L. HINTON (*Internatl. Sugar Jour., 23 (1921), No. 276, pp. 689-691*).—This is a contribution to the discussion of the reliability of the neutral double polarization method for the determination of sucrose as noted in papers by Browne and by Jackson and Gillis (E. S. R., 45, p. 317).

Determination of total carbon dioxide in baking powder, C. S. ROBINSON (*Jour. Assoc. Off. Agr. Chem., 5 (1921), No. 2, pp. 182-191, figs. 2*).—This contribution from the Michigan Experiment Station consists of a criticism of the Official methods of determining CO₂ in baking powder, with suggestions for avoiding some of the sources of error in the technique as described, and a description of a gasometric method of determining total CO₂ in baking powder which has been noted from another source (E. S. R., 47, p. 205).

The detection of ground bran in shorts, J. B. REED (*Jour. Assoc. Off. Agr. Chem., 5 (1921), No. 1, pp. 70-74*).—This and the following paper describe methods of detecting bran in shorts developed following the discovery of the practice in some mills of increasing the yield of shorts by grinding in the bran.

The method described in this paper consists essentially in separating the germ from the material by the use of an apparatus originally designed to separate seeds from lighter material. If the germ residue, as obtained in this way, is less than 2 or 3 per cent, the material can be considered to contain ground bran, since representative samples of shorts yield about 4 per cent of this residue.

The detection of the adulteration of shorts, D. B. BISBEE (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 74-76).—The method recommended for the detection of bran and other adulterants in shorts consists in first passing the sample through sieves of 20-, 40-, 60-, and 100-mesh. The portion retained by the 20-mesh sieve is considered to be bran only, that by the 40-mesh mostly bran with a few germ or endosperm particles, and that by the 60- and 100-mesh sieves decreasing proportions of bran and increasing amounts of germ and endosperm. The grades as thus separated are examined with a hand lens, the ash content of the original sample is determined, and also the content of crude fiber in each grade except the last.

The ash in bran is 6 per cent or more and in shorts from 5.5 to 2 per cent. The fiber in bran averages about 11 per cent, while in shorts it does not exceed 8.5 per cent. A mixture of reground bran and flour will have a fiber and ash content within the normal limits for true shorts, but the examination of the screenings will detect the adulteration, as the flour will pass all sieves. Ground rice hulls are very high in fiber and ash and can easily be detected by their appearance, as is also the case with weed seeds.

It is stated in conclusion that before passing judgment upon samples the analyst should examine known samples of true shorts of various grades and of known adulterated shorts.

The application of the theory of probability to the interpretation of milk analyses, H. C. LYRGOE (*Jour. Assoc. Off. Agr. Chem.*, 5 (1921), No. 1, pp. 14-28, figs. 13).—In this presidential address delivered at the 1920 meeting of the Association of Official Agricultural Chemists (E. S. R., 44, p. 99), the author reports the results of the use of the arithmetical probability paper of Hazen, as described by G. C. Whipple,¹ in studying the variations in the protein-fat ratio of milk when compared with other ingredients of the milk. The data used in the study consisted of analyses of the milk of over 1,000 individual cows from 116 herds, the cows being representative of all the usual dairy breeds, ages, and periods of lactation.

As the result of this study the general conclusion is drawn that a protein-fat ratio of less than 1 is no criterion that the milk is not adulterated. When less than 1 this ratio should be studied in relation to the figures obtained for solids, fat, and serum refraction, of which it is a function. Milk representing the mixed milk of many dairies can be declared skimmed when the protein-fat ratio is less than 1, if other analytical data are obtained to substantiate the conclusion and if a sufficient number of samples has been obtained to exclude the probability of the natural occurrence of milk with a low protein-fat ratio.

"Owing to the greater prevalence of high protein-fat ratios compared with low protein-fat ratios in milk from the average dairy herds, it is inaccurate to assume that the mixed milk of a number of herds would not greatly exceed in protein-fat ratio that of the average protein-fat ratio of the analyses on record.

"In comparing the composition of milk from individual cows with milk from herds, both the maximum and minimum figures obtained from individual cows, as a rule, are not found in herd milk. The protein fat ratio, however, is an exception, for but few of the highest figures so disappear because of the greater frequency of protein-fat ratios above the average."

A micro method for the estimation of ammonia in blood and in organic fluids, K. L. GAD-ANDRESEN (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 367-372, fig. 1).—The method described consists essentially in the evaporation to dryness of 1 cc. of blood to which sodium borate has been added and the collection of

¹ Jour. Franklin Inst., 182 (1916), Nos. 1, pp. 37-59; 2, pp. 205-227.

the volatilized ammonia in a small volume of dilute sulphuric acid. The evaporating apparatus consists of a glass tube 25 cm. by 10 mm. provided with a bulb in which the blood and borate are mixed. This is connected at one end by means of a bent glass tube with a wash bottle through which air enters the apparatus, and leads at the other end into the bottle of a microrespirometer containing 0.5 cc. of $N H_2SO_4$. The tube is immersed in a thermostat at about $25^{\circ} C$. while the air is being drawn through. With the air current carefully regulated to avoid splashing, the evaporation requires about 30 minutes, after which the ammonia is calculated in the usual way in the microrespiration apparatus.

A system of blood analysis.—Sup. III, **A new colorimetric method for the determination of the amino-acid nitrogen in blood**, O. FOLIN and H. WU (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 377-391).—In this third supplement to the system of blood analysis by Folin and Wu (*E. S. R.*, 42, p. 712), the second supplement to which by Whitehorn has been previously noted (*E. S. R.*, 45, p. 414), a direct method for the quantitative determination of the amino acids in the tungstic acid blood filtrate is described. The method depends upon the discovery that β -naphthoquinone sulfonic acid gives a red color with amino acids, but no coloration with any of the main nitrogenous products of blood except ammonia, which can be easily removed. For the color comparison a standard solution of glycine containing 0.07 gm. of nitrogen is used. The directions for preparing the various reagents and conducting the test are given in full. A table is also given showing the results obtained in colorimetric readings with different amino acids with glycine as a standard. Satisfactory results were obtained for all except arginine, which is to be made the subject of further investigation.

A colorimetric determination of the amino-acid nitrogen in normal urine, O. FOLIN (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 393, 394).—Directions are given for the application of the above method to the determination of amino-acid nitrogen in urine. This requires the removal of ammonia by a double extraction with permutit, after which the procedure is essentially the same as for blood.

Note on the necessity of checking up the quality of sodium tungstate used in the system of blood analysis, O. FOLIN (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 419, 420).—Attention is called to the fact that some samples of sodium tungstate do not react alkaline to phenolphthalein but are alkaline to litmus paper. For satisfactory results in the author's system of blood analysis the sodium tungstate should be adjusted to alkalinity to phenolphthalein.

New method in measuring sorghum sirup (*Wisconsin Sta. Bul.* 339 (1922), p. 112).—In a method devised by A. H. Wright for calculating the yield of sirup from a given lot of sorghum, the juice is run into vats so marked that by measuring the depth of juice in inches the number of gallons in each lot can be determined. The percentage of solids is then determined with a Brix hydrometer and, after deducting 1 or 2 per cent for waste in handling the juice, the number of gallons of juice is multiplied by the corrected percentage reading.

Potash from kelp.—V, **The applicability of kelpchar as a bleaching and purifying agent**, J. W. TURRENTINE and H. G. TANNER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 1, pp. 19-24).—In connection with the manufacture of potash from kelp, as described in previous papers of this series (*E. S. R.*, 46, p. 23), a bleaching carbon, "kelpchar," has been manufactured as a by-product and has been subjected to laboratory and plant scale tests to determine its value as a decolorizing agent. This paper reports the results of these tests and describes a simplified method of testing decolorizing carbons and various

methods for reactivating the spent carbon. The method found most satisfactory for evaluating the carbon is as follows:*

A stock solution is prepared by dissolving 50 gm. of cane molasses in about a liter of water, neutralizing the solution with sodium hydroxid or acetic acid as required, and adding 3 cc. of glacial acetic acid, 15 gm. of sodium acetate, and 2 cc. of formaldehyde. Eighty cc. of this solution is brought to boiling with 2 gm. of the carbon to be tested, the mixture is filtered while hot, and the filtrate matched with a set of filtrates prepared in the same manner with different quantities of a standard carbon.

Among the applications of kelpchar which have given good results are the decolorization of sugar sirups, as noted by Brewster and Raines (E. S. R., 46, p. 508), of caramel, glucose, citric acid, various oils and dye intermediates, and in the precipitation of metals such as gold from cyanid solution. Various other uses are listed.

The reactivation of kelpchar has been effected satisfactorily by established and new methods of reactivating carbons. Those proving most satisfactory are the retort method in which the carbon is washed, dried, heated in a retort at 800° C. and then cooled, washed with dilute hydrochloric acid and water, and dried; and the wet method in which the carbon is washed successively with dilute sodium hydroxid, water, hydrochloric acid, and water, and finally dried.

METEOROLOGY.

The seasonal march of the climatic conditions of a greenhouse, as related to plant growth, E. S. JOHNSTON (*Maryland Sta. Bul.* 245 (1921), pp. 41-98, figs. 7; *abs. in U. S. Mo. Weather Rev.*, 50 (1922), No. 4, pp. 197, 198).—Following the general method employed by McLean, referred to on page 412, buckwheat plants were grown for 4-week periods in the same culture solution and under other like environmental conditions during 13 months, a new period beginning every two weeks, there being 27 periods during the 13 months. One series was conducted under ordinary greenhouse conditions. The other was carried on in a cheesecloth inclosure in the same greenhouse.

"Measurements of stem height, dry weight, leaf area, and transpiration were made at regular intervals. . . . Simultaneous measurements of evaporation, radiation, and temperature were also obtained. . . .

"The seasonal march of the 4-week plant growth rates may be summarily described as follows: The rates for stem elongation, for dry-weight increase, and for leaf-area increase had high summer values and low winter ones. These values increased during the spring and decreased during the autumn. The rates of transpirational water loss varied throughout the year in a similar manner, but they showed low values about the summer solstice. The rates of stem elongation also showed remarkably low values for a period about the time of the summer solstice. The approximate annual ranges (ratios of maximum to minimum) were as follows: Rate of stem elongation, 2; rate of dry-weight increase, 8; rate of leaf-area increase, 5; rate of transpirational water loss, 9.

"The climatic efficiency values within the cheesecloth chamber in the greenhouse appear, in general, to have been lower than those in the unshaded greenhouse, the exceptions being the values for stem height and for leaf area, for periods about June 21. The evaporation and radiation indices for the sheltered series are much lower than those for the exposed series. Very little difference is to be noted between the corresponding temperature values for the cheesecloth chamber and for the unshaded greenhouse.

"While the interpretation of the plant values in terms of those derived from the instruments offers many difficulties, nevertheless the following striking features of this environmental complex that are registered in the records of both plants and instruments may be mentioned: (1) Fairly good agreement exists between the daily mean temperatures and the transpiration rates, while none of the other plant values shows such agreement with the mean temperatures. (2) The summer values for average daily temperature range and those for transpiration vary in the same direction. (3) Along with high evaporation rates in late summer occur high temperatures, radiation, and transpiration values, but low values for the rates of increase in dry weight and in leaf area. (4) A rather general agreement is to be observed between the radiation values and the areal coefficients of weight increase and of transpiration, but there is no very marked agreement between the radiation values and those of the water requirement. (5) With the exception of the water requirement of the plants and the evaporating power of the air, the values here studied (both plant and instrumental) exhibit low magnitudes for the winter period.

"Where stem elongation is used as a criterion of growth, measurements taken after an exposure period of two weeks appear to be as satisfactory as those taken after a period twice as long. . . . These buckwheat plants appear to have been generally much more sensitive to climatic influence during the first two weeks than during the second. For the rate of stem elongation, and possibly also for that of transpiration, it appears that a period of low values occurs about the summer solstice."

A physiological study of the climatic conditions of Maryland, as measured by plant growth, F. M. HILDEBRANDT (*Physiol. Researches*, 2 (1921), No. 8, pp. 341-405, figs. 8).—This paper is based upon field work by McLean, previously noted (*E. S. R.*, 36, p. 809), and presents the results of a study of a series of observations on the climatic complexes for nine well distributed stations in Maryland, as the effectiveness of each complex was automatically integrated by soy bean plants grown for a period of four weeks from the seed, new seeds being planted every two weeks. The plant measurements furnishing data employed in this study were (1) stem height, (2) leaf area, (3) leaf product (length multiplied by width), and (4) dry weight. The climatic data recorded and used were (1) air temperature, (2) the evaporating power of the air, and (3) sunlight intensity and duration.

"Considering the soy bean plant (as here employed) as a standard plant or indicator for the measurement of climatic efficiency to produce plant growth, it appears that, for the season of 1914, the climatic complexes for some culture periods were more efficient in this sense than might be expected from an attempt to interpret the corresponding climatic data, while the complexes for other periods were actually less efficient to produce soy bean growth than might be surmised from the corresponding climatic values. . . . The seasonal means derived from the plant data give relatively low efficiency values for the climatic complexes of the three western stations (Oakland, Chewsville, and Monrovia), high values for the complexes of Baltimore and Darlington, and intermediate values for the complexes of the remaining stations (College, Coleman, Easton, and Princess Anne).

"If indices for total seasonal climatic efficiency are derived by multiplying the seasonal average growth rate per day by the normal length (days) of the growing season for the station in question, these indices have the following values for the several stations: Oakland, 9,009; Chewsville, 12,480; College, 16,867; Easton, 17,688; Princess Anne, 19,005; Coleman, 21,115; Darlington, 23,688; Baltimore, 25,422. In considering these relative climatic indices it

should be emphasized that the data of this study do not involve precipitation as an influential climatic feature; the culture plants were automatically irrigated, so that they never suffered from lack of soil moisture. . . .

"It appears that the rate of stem elongation was greater than the rate of leaf expansion when both were relatively small, while the former rate was the smaller of the two when both were relatively large. The rate of production of dry weight appears to have been nearly proportional to the rate of increase of leaf surface; the relative values of these two growth criteria are generally about equal numerically. The statements just made apply to the data for plants quite openly exposed, but some observations on cultures somewhat protected above by glass were available, and also a set of observations on cultures in forest at Baltimore. These all indicate that the height rate was relatively greater than the rate of leaf expansion for these more or less shaded conditions, while the rate of dry-weight production was smaller than the corresponding rate of leaf expansion. . . .

"The climatic data themselves showed a pronounced general agreement between the graph for sunlight and the corresponding one for evaporation (standardized white cylindrical porous-cup atmometer), this being probably due to the relatively great importance of solar radiation in determining the evaporation rate. The climatic values indicate a general seasonal march, which is very evident for temperature, less so for sunlight, and rather obscure for evaporation. For details regarding the climatic values, as well as for the plant values, reference must be made to the tables and graphs and to the text of the paper."

The degree to which plants can be considered as integral factors capable of measuring the complex effect of climatic factors (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 8, pp. 934-941).—This is a review of work by P. A. Lehenbauer, B. E. Livingston, and F. T. McLean, previously noted (*E. S. R.*, 32, p. 334; 35, p. 328; 36, p. 809), and by Hildebrandt, noted above, dealing especially with the relative efficiency of different climatic factors, heat, light, moisture, and evaporation, in so far as "they influence plant growth and furnish points of reference for the comparative quantitative study of climatic conditions as a whole."

The problem of agricultural ecology, G. Azzi (*U. S. Mo. Weather Rev.*, 50 (1922), No. 4, pp. 193-196).—The essential features of a thorough study of this problem are outlined. Such a study involves:

"Collection of data.—To obtain meteorological figures and biological data for comparison, observations on meteorological factors and biological researches will be conducted on parallel lines in the same place.

"Elaboration of data.—Leading to the determination of (1) critical periods, (2) frequency and intensity of the different meteorological phenomena, (3) phenological means. Points 1-3 enable one exact biometeorological balance to be established.

"Application of data (worked out as above).—Leading to the following results: (1) Choice of the variety most suitable to the given conditions, (2) best dates for sowing, (3) most suitable cultural operations to escape unfavorable climatic conditions and best times for carrying them out, (4) a practical knowledge of environment for the plant breeder to enable him to obtain the type most likely to succeed under actual meteorological conditions."

The article gives a set of general rules to be followed in making the biometeorological observations necessary to establish "(1) the critical period, (2) phenoscopic averages, (3) the percentages of probability of the various meteorological phenomena for each 10-day period during the season of growth, (4) decrease of the yield caused by various unfavorable conditions."

In the author's opinion "the use of the method suggested and described would lead to the following results:

"(1) It would show which among the many varieties of a cultivated species, such as wheat, is the most suitable for a given district. The tendency to use and introduce over too-wide areas and in surroundings somewhat different from their place of origin the new products obtained by selection, or crossing combined with selection, has already led to many serious disappointments.

"(2) It would show the best date for sowing with the view of making the critical periods coincide with the most favorable weather conditions without leaving out of account the length of the solar day, which exercises so great an effect upon the life of the cultivated plant.

"(3) It would demonstrate the most suitable cultural operations and the best time to carry them out with the object of controlling the negative action of unfavorable meteorological factors or phenomena.

"(4) It would guide the plant breeder in his efforts to unite in a single individual and in the best proportions for obtaining the maximum yield the character of 'specific productivity' and of 'resistance to the most injurious meteorological phenomena.'"

Douglass on climatic cycles and tree growth, A. J. HENRY (*U. S. Mo. Weather Rev.*, 50 (1922), No. 3, pp. 125-127, figs. 4).—This is a critical review of work which has previously been noted from another source (*E. S. R.*, 42, p. 417).

Clements on drought periods and climatic cycles, A. J. HENRY (*U. S. Mo. Weather Rev.*, 50 (1922), No. 3, pp. 127-131, fig. 1).—This is a critical review of a paper which has been previously noted from another source (*E. S. R.*, 40, p. 209), dealing especially with the work of Douglass "in relating the annual rings of trees to rainfall and the sunspot cycle as suggesting the possibility of using the latter for forecasting the rainfall from year to year. . . . The difficulty of combining rainfall statistics for large areas is discussed; it is also pointed out that investigations of the suggested relation between the occurrence of sunspots and terrestrial rainfall have been made in various parts of the world, and further that the net result of those investigations is inconclusive and in some cases conflicting."

The new precipitation section of the Atlas of American Agriculture, R. DeC. WARD (*U. S. Mo. Weather Rev.*, 50 (1922), No. 3, pp. 117-124, figs. 9).—This section, which comprises 16 diagrams and 69 maps, is described and critically discussed, especially from the standpoints of departures from average rainfall, rainfall types, day and night rains, thunderstorms and hail, and fog and cloudiness. It is stated that "the whole folio deserves, and will surely receive, very careful and serious study on the part of all who have any interest in United States climates, and will do much to establish American climatology on a higher plane of scientific accuracy."

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 3, pp. 117-172, pls. 14, figs. 19; 4, pp. 173-228, pls. 22, figs. 6).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for March and April, 1922, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 3.—The New Precipitation Section of the Atlas of American Agriculture (illus.), by R. DeC. Ward (see above); Douglass on Climatic Cycles and Tree Growth (illus.), by A. J. Henry (see above); Clements on Drought Periods and Climatic Cycles (illus.), by A. J. Henry (see above); An Unusual Halo Observed

at New Haven, Conn., February 25, 1922, by C. S. Hastings; Complex Solar Halo Observed at Ellendale, N. Dak., by C. S. Ling; An Angle-measuring Device for Halo Observers (illus.), by J. H. Gordon; Recent Contributions to Dynamical Meteorology, by E. W. Woolard; Short Method of Obtaining a Pearson Coefficient of Correlation, and Other Short Statistical Processes, by F. M. Phillips; Climate and Photography, by H. G. Cornthwaite; Anomalous Storm Tracks (illus.), by E. H. Bowie; Temperatures of the Soil and Air in a Desert (illus.), by J. G. Sinclair (see below); and Damage to Wire Service by Heavy Snowstorm in Kansas, by S. D. Flora.

No. 4.—Formation and Movement of West Indian Hurricanes (illus.), by E. H. Bowie; Hourly Precipitation at Nashville, Tenn. (illus.), by R. Nunn; Tornadoes of April, 1922 (illus.), by A. S. Henry et al.; Rainfall and Flood at Fort Worth, Tex., by D. S. Landis; Rainfall of Colombia, South America, by A. J. Henry; Meteorological Notes on Canton, China, by G. D. Hubbard; and The Problem of Agricultural Ecology, by G. Azzi (see p. 413).

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 8 (1921), No. 13, pp. [235], pls. 22, figs. 14).—This number summarizes the climatological data for each month of 1921 and for the year as a whole for each State.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 9 (1922), Nos. 3, pp. [196], pls. 3, fig. 1; 4, pp. [195], pls. 4, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for March and April, 1922, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 401-402 (192), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1922, are presented. The data are briefly discussed in general notes on the weather of each month.

[**Climatic conditions at the San Antonio Experiment Farm in 1919 and 1920**], G. T. RATLIFF (*U. S. Dept. Agr., Dept. Circ.* 209 (1922), pp. 4-7).—The data from observations on temperature, precipitation, evaporation, wind, and frostless period are summarized for 1919 and 1920 and compared with the averages for the 14-year period 1907-1920.

The winters of 1918-19 and 1919-20 were mild. The frost-free period was 274 days, February 28 to November 29, in 1919, and 224 days, April 4 to November 14, in 1920. The rainfall in 1919 was 48.62 in., the highest since 1877, and in 1920, 22.13 in. The average for the 14 years, 1907-1920, has been 25.14 in. The total evaporation from a free water surface was 50.56 in. in 1919 and 60.12 in. in 1920, as compared with the 14-year average of 66.7 in.

Temperatures of the soil and air in a desert, J. G. SINCLAIR (*U. S. Mo. Weather Rev.*, 50 (1922), No. 3, pp. 142-144 figs. 2).—Observations at the desert laboratory at Tucson, Ariz., show a very large daily and yearly range of temperature in the surface soil, the daily range being so nearly the yearly range that the effects are not transmitted much beneath the surface.

SOILS—FERTILIZERS.

Iroquois County soils, J. G. MOSIER, S. V. HOLT, E. VAN ALSTINE, and H. J. SNIDER (*Illinois Sta. Soil Rpt.* 22 (1922), pp. 60, pls. 4, figs. 7).—This survey deals with the soils of an area of 719,116 acres on the eastern border of Illinois. The topography varies from flat to slightly rolling. With the exception of a few

small areas in the northwestern part, the entire county is drained by the Iroquois River and its tributaries. These streams, together with dredged ditches, are said to provide a very good system of drainage.

The soils of the county are of glacial and loessial origin and are grouped as upland prairie, upland timber, terrace, and swamp and bottomland soils. The brown silt loam upland prairie soil is the most extensive type, covering 60.63 per cent of the area.

Chemical analyses and field experiments to determine the fertility requirements and crop adaptations of the prevailing soil types are also reported. These indicate that the soils are relatively deficient in phosphoric acid and nitrogen, but that they are well supplied with potash.

The chemical composition of the soils of the Belvidere area in New Jersey, A. W. BLAIR and H. C. McLEAN (*New Jersey Stat. Bul.* 362 (1922), pp. 16, figs. 2).—The results of chemical studies of the soils of the Belvidere area of New Jersey, made to supplement the physical study conducted in cooperation with the U. S. Department of Agriculture (E. S. R., 44, p. 18), are reported and discussed.

Analyses were made of about 100 samples, including subsoils. With comparatively few exceptions, there was found to be a striking similarity in the chemical composition of the different soils of this area. In the majority of surface samples the nitrogen ranged between 0.09 and 0.14 per cent, and the phosphoric acid was about the same or slightly less. The potash approached 2 per cent or more, and the lime varied from about 0.2 to 0.5, the magnesia from about 0.75 to 2, and the total carbon between 1 and 2 per cent. With one exception, the nitrogen and carbon contents were higher in the surface than in the subsoil. The phosphoric acid content was slightly higher in the surface soil than in the subsoil. Quite frequently there was more potash in the subsoil than in the surface soil, and this is considered an argument for deep plowing and for deep rooting crops. About half of the soils of the area were found to require lime treatment.

The chemical composition of the soils of the Millville area in New Jersey, A. W. BLAIR and H. C. McLEAN (*New Jersey Stat. Bul.* 366 (1922), pp. 15, figs. 4).—Results of chemical studies of the soils of the Millville area, N. J., made to supplement the physical study conducted in cooperation with the U. S. Department of Agriculture (E. S. R., 44, p. 718) are presented and discussed.

A total of 66 samples, including subsoils, were analyzed, the majority being taken from the Sassafras series. With comparatively few exceptions, these soils were found to be low in total plant nutrient content when compared with the average soils of the State. Lime and magnesia were deficient in all soils analyzed except in tidal marsh soils. Without exception, a higher percentage of nitrogen was found in the surface soil than in the subsoil, and the majority of these soils showed a rather high lime requirement.

Water-holding capacity of sandy soils (*Wisconsin Sta. Bul.* 339 (1922), pp. 77, 78).—Cylinder studies by H. W. Stewart of the moisture factors of medium sand, fine sand, and sandy loam showed that sandy loam utilized its moisture more efficiently than the sands, particularly in the production of corn, oats, and oats straw. It was also found that sands are not adapted to the production of oats, and that the utilization of moisture in sandy loam was not much better than that of the sands in the production of soy beans, clover, and corn stover. The sands were found to supply moisture to soy beans nearly as well as sandy loam. Over 500 moisture determinations showed that the sandy loam had an average moisture content to a depth of 40 in., twice that of the sands, and that after June 27 the average moisture content to the same depth was slightly lower in the fine sand than in the medium sand.

A study of the penetration of rain showed that the soils of coarser texture allow the rain to penetrate deeper than do the finer textured types. This was further borne out by the fact that crops such as clover, soy beans, and corn were relatively much better on the coarser types of sandy soil than were those, such as oats, with their root system growing near the surface.

The relation of concentration of soil solution to nitric nitrogen in soils containing large quantities of available nitrogen, and their effect upon plant growth (*New Mexico Sta. Rpt. 1921, pp. 24, 25*).—It has been found that on the whole nitrates were not toxic except where there were excessive quantities, and even then there was greater injury due to the combined sulphates and chlorids. The plants showed an irregular decrease in yield as the total salts increased. A preliminary field survey showed that where nitrates were in excessive quantities other soluble salts also occurred in excessive quantities, but as the total salts increased the nitrates increased more rapidly than the total salts.

Partial sterilization or disinfection of soil: Its effects and their causes, G. TRUFFAUT and N. BEZSSONOFF (*Sci. Sol. [Truffaut], 1 (1922), No. 1, pp. 61, pls. 10, figs. 3*).—This report is divided into two parts.

Part 1 reports studies on the influence of partial sterilization on crop yields and nitrogen economy. Partial sterilization was effected by the use of heat and active chemicals, including aromatic and oily carbon compounds and organic and mineral sulphur compounds.

In the first series of experiments with chemicals it was found that calcium sulphid gave the best results and was most effective when used at rates of from 30 to 40 gm. per square meter of soil (about 0.9 to 1.2 oz. per square yard). About as good results were obtained when calcium sulphid was used in conjunction with an aromatic such as naphthalene.

In a second series of experiments with seven antiseptics the best results were obtained with sulgine, or calcium sulphid reinforced with calcium carbonate. Medium results were given by chloro-*o*-cresol and chloro-*m*-cresol. All of the antiseptics used increased crop yields not less than 37 per cent. It was also found that when a sufficiency of lime, potash, magnesia, and phosphoric acid is present in soil partial sterilization produces about the same increases in crop yields as is caused by the addition of ammonium sulphate or sodium nitrate in proper amounts. The addition of magnesia, manganese, or zinc in small amounts to antiseptics seemed to improve their action.

The second part of the report deals with studies of special microflora in partially sterilized soils. It was found that in soils treated with an antiseptic having a calcium sulphid base the numbers of *Clostridium pastorianum* were three times as great as those in untreated soils. The fixation of nitrogen by *C. pastorianum* was rendered more energetic by such treatment. The development of *Azotobacter chroococcum* was more intense, and the bacterial flora were richer in ammonifying organisms, such as *Bacillus megatherium*, *B. mycoides*, and *B. arborescens*, in the treated soil. Over a period of 75 days there was a marked decrease in the total number of protozoa and a marked increase in the total number of bacteria in treated soils.

It is concluded that in general a treatment of soil with certain antiseptics will assure sufficient nitrogen nutrition of crops without the necessity of adding nitrogenous fertilizers, and will increase the nitrogen supply of the soil, largely by fixation from the atmosphere.

Does deep tillage pay? (*Wisconsin Sta. Bul. 339 (1922), pp. 84, 85*).—The results of several years' study by F. L. Musbach of deep tillage at the Marshfield Substation are said to have shown that deep plowing and subsoiling are

not profitable. Corn on a 5-year average gave the best yields on spring plowed land followed by ordinary fall plowing to a depth of from 6 to 7 in., while with oats 9-year tests showed a slightly higher yield on spring plowed than on fall plowed land. Deep tilling gave the lowest yield with both corn and oats.

The fertilizer industry in the United States, J. G. LIPMAN (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 11, pp. 233R-237R).—This is a brief contribution from the New Jersey Experiment Stations, presented before the Chemical Industry Club of London on May 24, 1922. The author discusses sources of fertilizer materials in the United States and the manufacture of artificial fertilizers. It is stated that under normal conditions the consumption of artificial fertilizers in the United States is equivalent to about 7,000,000 long tons, and that the industry in the United States represents an investment of several hundred million dollars.

The Southern States are said to have used in the past as much as two-thirds of the entire fertilizer tonnage of the United States, most of which has been used for the cotton crop. North Carolina, South Carolina, and Georgia used in a normal year considerably more than 3,000,000 tons. An attempt is made to forecast the future development of the manufacture and use of artificial fertilizers in North America.

Changes in the composition and cost of fertilizers in New York from 1914 to 1921, L. L. VAN SLYKE (*New York State Sta. Bul.* 493 (1922), pp. 3-12).—A general review is given of conditions relating to the kinds, composition, and prices of fertilizers in the State of New York before, during, and after the war. The indications are that normal conditions are gradually returning in these respects. Owing to the complexity of conditions, it is stated that future changes can not be safely predicted, but it is believed that the tendencies noticed during the two years will continue for some time.

Fertilizers for Maryland soils, A. G. MCCALL (*Maryland Sta. Bul.* 247 (1922), pp. 117-151, figs. 7).—Practical information on the selection, purchase, and use of fertilizers for Maryland soils, based on studies of the fertility requirements of different soils of the State by the station, is presented in this bulletin.

Soil fertility experiments on DeKalb, Volusia, and Westmoreland soils (*Pennsylvania Sta. Bul.* 170 (1922), pp. 11, 12).—Lime and fertilizer studies in the nature of permanent field plot experiments on the three soils showed a wide difference in their degree of response to the several fertilizer ingredients. Phosphorus gave a 54 per cent increase over lime on DeKalb soil, 4 per cent on Volusia, and 38 per cent on Westmoreland. The addition of potash increased the yield of the calcium plus phosphorus treatment by 30 per cent on DeKalb soil, 22 per cent on Volusia, and only 1 per cent on Westmoreland soil. The addition of nitrogen to the calcium-phosphorus-potash treatment resulted in a 16 per cent increase in yield on DeKalb soil, 19 per cent on Volusia, and 24 per cent on Westmoreland soil. Acid phosphate gave greater yields than rock phosphate in every case with one exception.

Fertilizer work on light soil at Spooner (*Wisconsin Sta. Bul.* 339 (1922), pp. 81, 82).—Fertilizer work by F. L. Mushbach and A. R. Whitson on light sand soils showed that, with corn, oats, and clover, manure alone was apparently sufficient to supply the necessary plant nutrients. With potatoes the highest yields were obtained where stable manure was supplemented with mineral fertilizers.

Fertilizer experiments in the Neustadt district conducted during 1921 by the Agricultural Commission for Saxe-Weimar, KUNZEL (*Deut. Landw. Presse*, 49 (1922), Nos. 7, p. 45; 8, pp. 54, 55; 9, pp. 61, 62).—The results of 10

demonstrations with wheat and of 5 with potatoes, conducted in the Duchy of Saxe-Weimar in Germany for the purpose of supplying practical information on the relative fertilizing values of a number of the newer nitrogenous fertilizers, are presented in tabular form and briefly discussed.

Potassium ammonium nitrate and ammonium sulphate nitrate seemed to give the best results on wheat, the latter being slightly the more effective. Ammonium sulphate and ammonium sulphate nitrate gave the best results with potatoes, and there was little difference between their respective actions.

The substitution of stable manure by fertilizers, green manures, and peat. B. L. HARTWELL and F. K. GRANDALL (*Rhode Island Sta. Bul. 188 (1922), pp. 4-23, fig. 1*).—The results of the first six years of a study are reported in which an annual spring application of 32 tons of stable manure alone was compared with different combinations of fertilizer chemicals used in connection with green manures, peat, and smaller amounts of stable manure in a 3-year rotation, including cabbage followed by beets, tomatoes followed by spinach, and lettuce followed by celery, and the same rotation modified by omitting the beets, spinach, and lettuce in order to grow green manure crops.

In the rotation unmodified by green manure crops, 16 tons of manure was supplemented in the spring by fertilizer chemicals equivalent to 1,500 lbs. of a 4-10-2 fertilizer and the same augmented singly with more of each ingredient. Peat composted with lime and supplemented with fertilizer chemicals was applied by itself to furnish the same amount of organic matter as was contained in the 16 tons of stable manure.

The yields of the early crops in this rotation were larger with 16 tons of manure and the 4-10-2 fertilizer than with 32 tons of manure without the fertilizer. A comparison of the augmented fertilizer with the 4-10-2 fertilizer showed that additional nitrogen increased the crop of cabbage and ripe tomatoes but not the lettuce. Additional phosphorus increased the cabbage and lettuce but not the tomatoes. An extra amount of potassium caused no increases. The peat and fertilizer compared with the manure and standard fertilizer gave about the same yield of cabbage, a third less of tomatoes, and very much less lettuce.

The late crops of the stable manure rotation received no fresh application of manure, and the first comparison was between the residues from the spring application of 32 tons of manure alone and of the 16 tons supplemented with a second application of fertilizer chemicals equivalent to a half ton of 4-7-6 fertilizer. The fertilizer and half ration of manure residues increased the beet yield 23 per cent and the spinach 12 per cent more than the residues for the maximum spring application of manure. There was practically no increase in the case of late celery. All three crops were increased by adding extra nitrogen and phosphorus to the second fertilizer. An addition of potassium increased only the yield of spinach.

The foregoing rotation was modified to grow winter vetch, rye, and wheat in place of late beets, and sweet clover, red clover, rape, and oats in place of late spinach and early lettuce. With one exception the green manure plats received no stable manure. The early cabbage and tomatoes received the equivalent of a ton of 4.5-8-2 fertilizer and the late celery the equivalent of 2,500 lbs. of 4.5-7-3 fertilizer. Only about a 10 per cent increase was attained in any case by an extra amount of any of the ingredients in these fertilizers, and usually there was no positive increase. The green manure plats yielded more cabbage than the plats receiving only manure but about a fourth less tomatoes and celery. Where in one case 8 tons of manure was added each spring to supplement the green manures and fertilizer, there was a slight gain in yield.

Composting rock phosphates with organic ammoniates (*Georgia Sta. Rpt. 1921, p. 9*).—It is stated that when a mixture of cottonseed meal, rock phosphate, and soil was composted for five months, from 60 to 70 per cent of the total nitrogen and from 25 to 35 per cent of the dry matter were lost. The addition of a small amount of ammonium sulphate lowered the loss of dry matter to 8 per cent, while 60 per cent of the nitrogen was lost. The total phosphorus made available during the composting ranged from 7 to 20 per cent. The use of large proportions of costly ammoniates such as cottonseed meal in a compost mixture is considered inadvisable under ordinary conditions.

[**Soil fertility studies in Louisiana**], C. D. CAIN (*Louisiana Stas. Rpt. 1921, pp. 11, 12*).—It is stated that the results of a 3-year rotation experiment where a compost made of cotton seed, stable manure, and acid phosphate was used showed clearly that it is essential to have organic matter in the sandy soil of north Louisiana in order to get favorable results with commercial fertilizers. The plats where compost was used for a long time gave more than twice the yields of cotton, corn, oats, and pea-vine hay than plats where commercial fertilizer was used alone. Where commercial fertilizer was used in connection with stable manure the yield of cotton was increased 15 per cent over that from plats where stable manure was used alone. Stable manure seemed to be the most essential need for corn in the sandy hill sections, and sodium nitrate gave good results for oats.

Top-dressing of pastures, E. BREAKWELL (*Agr. Gaz. N. S. Wales, 33 (1922), No. 4, pp. 267-269*).—The results of three years' experiments on the top-dressing of pasture soils, consisting of trials of different fertilizers on plats containing a mixture of introduced grasses and cow grass clover, are reported.

The application of fertilizers to introduced grasses on different soils was found to be distinctly beneficial. Superphosphate and potassium sulphate appeared to be as beneficial if not more so than a complete fertilizer which included sodium nitrate. The use of superphosphate and potassium sulphate resulted in a remarkable increase in the clover over the grasses. The use of the complete fertilizer, including sodium nitrate, appeared to result in a more balanced proportion of legumes and grasses.

Irrigation and fertilization with wet activated sludge, H. C. H. SHENTON (*Canad. Engin., 41 (1921), No. 8, pp. 10, 13*).—The results of a number of studies from different sources on the fertilizing value of wet and dry activated sludge are summarized and discussed. Attention is drawn to the difficulty of drying activated sludge owing to the large bacterial and protozoan content. It is concluded that wet activated sludge can be pumped several miles onto fields at a cost comparable to that of railway carriage, cartage, and distribution, and that the distribution of liquid sludge will under favorable conditions be much cheaper than the preparation and distribution of dried sludge.

The utility of starfish as fertilizer, A. VACHON (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 14 (1920), Sect. V, pp. 39-49*).—Chemical analyses of raw and specially treated and dried samples of starfish are described and discussed. The dried starfish contained lime 17.11 per cent, magnesia 1.42, sulphates 0.32, potassium 0.074, phosphoric acid 0.3, and total nitrogen 0.77 per cent.

Mineral resources of the Waynesboro quadrangle, Tenn., H. D. MISER (*Tenn. Geol. Survey Bul. 26 (1921), pp. 171, pls. 16, figs. 7*).—This investigation includes sections on limestone and phosphate rock.

The technical production of nitrogen, ammonia, and ammonium sulphate, G. SCHUCHARDT (*Samml. Chem. u. Chem. Tech. Vorträge, 25 (1919), pp. 213-260, figs. 13*).—Technical methods, processes, and apparatus are discussed, and an existing plant for the manufacture of ammonium sulphate is de-

scribed. A list of German patents for the obtaining of nitrogen and the manufacture of ammonia and ammonium sulphate is also given.

Catalysis and synthesis of ammonia, P. FIRMIN (*Indus. Chim. [Paris]*, 9 (1922), No. 99, pp. 147-151, figs. 4).—An analysis is given of the factors involved in the catalysis and synthesis of ammonia, accompanied by curves and tables of data. Such factors as temperature, pressure, type, and surface area of catalyst, gas velocity, etc., are discussed.

Experimental research on the manufacture of nitrates by biochemical oxidation of ammonia, E. BOULLANGER (*Ann. Inst. Pasteur*, 35 (1921), No. 9, pp. 575-602).—Studies on the biochemical oxidation of ammonium solutions in a peat medium for the production of nitrates are reported. The peat was placed in small glass beakers and treated at regular intervals with solutions containing different ammonium compounds and calcium carbonate. The peat was also inoculated with cultures of nitrifying bacteria.

It was found that the addition of more than 200 liters of a solution containing ammonium sulphate per cubic meter of peat per day retarded the development of the nitric ferment. This is attributed to the excess of ammonia. The use of much smaller treatments was more satisfactory, and additions of a solution containing 2.5 gm. of ammonium sulphate per liter at rates of from 20 to 40 liters per cubic meter of peat per day permitted the multiplication of the nitric ferment and prevented the incomplete oxidation of ammonia to nitrites. These treatments could be increased little by little, but not to exceed 200 liters per cubic meter of peat per day of a solution of 7.5 gm. of ammonium sulphate per liter of water. Any stronger treatments increased the quantity of unnitrified ammonia. When the solution contained 1.5 gm. of ammonia and from 40 to 50 gm. of calcium nitrate per liter nitrification was much retarded, and it was necessary to reduce the rate of treatment to a maximum of from 75 to 100 liters per cubic meters of peat.

The presence of nitrates at the beginning was found to interfere with the multiplication of the nitrifying bacteria. For this reason better results were obtained when the first treatment was made with ammonium sulphate solution than when ammonium nitrate was used. After the nitrifying population was well established, it was possible to use a solution of ammonium nitrate without trouble. The best results were obtained with ammonium nitrate solution produced by the double decomposition of ammonium bicarbonate and a solution of calcium nitrate drained from the nitrifying medium. This process of producing ammonium nitrate had considerable advantage from the industrial standpoint over the processes involving the double decomposition of ammonium sulphate and calcium nitrate, since the formation of calcium sulphate was avoided and the lime was recovered in the form of calcium carbonate and used again in the nitrifying solution.

It was possible to obtain the maximum production of nitrates by repeated additions of the ammonia solution to the same nitrifying bed, and the use of several beds in series by passing the effluent from one to the other is considered unnecessary. The highest concentration obtained by this procedure was 138.2 gm. of calcium nitrate per liter, but the treatments required for this gradually arrested nitrification. It was found possible to produce regularly a concentration of 120 gm. of calcium nitrate per liter.

It was further found that such materials as puzzolan and light, porous volcanic slags may be advantageously substituted for peat in this process and overcome a number of the difficulties attending its use.

The effect of rock phosphate upon the corn possibility of the phosphoric acid of the soil, G. S. FRAPS (*Texas Sta. Bul.* 289 (1922), pp. 5-17, figs. 5).—

Pot experiments to determine the effects of rock phosphate upon the removal of phosphoric acid from soil by corn and sorghum are reported. The soils used were deficient in active phosphoric acid.

Fifty crops on about 25 soils removed an average of 5.53 parts per million of phosphoric acid with no phosphate treatment, while with 1 ton of rock phosphate, equal to about 300 parts of phosphoric acid per million of soil, the phosphoric acid removed was increased to 9.43 parts per million. The average percentage of phosphoric acid removed from rock phosphate was 1.3 and from soil phosphates from 0.5 to 1.75.

Increasing the phosphoric acid added in rock phosphate from 300 to 600 parts per million increased the removal of phosphoric acid from soil per crop an average of only 0.63 parts per million. The percentage of added phosphoric acid removed was 1.4 for 300 parts per million and 0.8 for 600 parts per million on the same crop on the same soil. The percentage of added phosphoric acid removed per crop was 1.43 when 1 ton of rock phosphate per acre was added, 0.8 when 2 tons were added, and 0.5 when 4 tons were added. It is noted that additions of rock phosphate exceeding 1 ton to the acre had comparatively slight effects upon the amount of phosphoric acid removed by crops, the additions following the law of diminishing returns and the returns diminishing rapidly.

Soft Florida phosphate was slightly more effective than hard Tennessee phosphate. The percentage of added phosphoric acid removed was 1.98 for the former and 1.52 for the latter. The amount of phosphoric acid removed from dicalcium phosphate was much greater than that removed from rock phosphate, and was not approached by the large applications of phosphates.

It is concluded that the phosphoric acid of rock phosphate when added to the soil is not as highly available as the active phosphoric acid already present in the soil.

Potassium supply of the soil (*Ohio Sta. Bul. 353 (1921), pp. XII, XIII*).—Studies to determine to what extent lime and various fertilizer materials, including gypsum, sodium nitrate, ammonium sulphate, and phosphates, are effective agencies for converting soil potassium into available forms are said to indicate that whatever effect calcium sulphate, sodium nitrate, and other materials may have for increasing the availability of potassium, it is chiefly that of releasing potassium which has accumulated in an absorbed or fixed condition after the continuous breaking down of potassium minerals by various agencies. These materials are said to release more potassium from soil that has received additions of soluble potassium salts for a period of years than from unfertilized soil. The absorption of soluble potassium salts is less when the soil has been fertilized with potassium.

Lime requirement of the soils of New Hampshire (*New Hampshire Sta. Bul. 203 (1922), pp. 18, 19*).—A summary of the results of lime requirement determinations by H. R. Kraybill of soils from six New Hampshire counties is presented in tabular form. This requirement, as determined by the Truog method, varied from $2\frac{3}{4}$ to $3\frac{1}{4}$ tons of ground limestone per acre.

Lime top-dressing experiment (*Pennsylvania Sta. Bul. 170 (1922), p. 24*).—A lysimeter study to determine how far slaked lime and ground limestone will travel downward in a bare fallow soil and a soil covered with a closely trimmed sod when exposed to the weather showed that more than one-half of the lime in either form remained in the place at which it was applied and only one-fourth moved downward more than 1 in. in the soil. It was found inadvisable to use lime as a top-dressing in a compact loam or clay soil, but that the lime should be worked into the soil.

The fate of the coarse limestone particles in plat 34 of the general fertilizer experiments (*Pennsylvania Sta. Bul. 170 (1922), p. 24*).—An exam-

ination of samples of soil which six and a half years previously had been treated with coarse limestone particles, some of which did not pass a 12-mesh sieve, showed that both the coarse and medium particles had the fresh blue color of the original stone and showed well-defined, sharp angles indicating little weathering. This field test is said to confirm the pot experiments carried out by the station showing that coarse limestone is not of economic value to the farmer, and that for serviceability the finer the stone the better the result.

Relative value of different forms and amounts of lime (*Pennsylvania Sta. Bul. 170 (1922), p. 12*).—Studies of the relative values of ground burnt lime, hydrated lime, and ground limestone when applied in different amounts in a rotation of corn, oats, wheat, and hay showed that the three forms of lime have equal agricultural value, but that the costs of burnt and hydrated limes are excessive as compared to the cost of limestone.

Influence of silicates on growth of plants and on their utilization of phosphorus (*Ohio Sta. Bul. 353 (1921), p. XIII*).—The favorable effects of blast-furnace slag and other silicates on crop growth are attributed to the calcium and magnesium furnished. Increased amounts of silica are said to have been assimilated by plants grown on soil receiving additions of different forms of soluble and insoluble silicates. No evidence was obtained that the utilization of phosphorus by plants was appreciably influenced by added silicates.

Effects of borax on plant life (*New Hampshire Sta. Bul. 203 (1922), p. 27*).—Studies by J. R. Neller of the influence of borax on corn, potatoes, and beans showed that a given borax application was most liable to be harmful if applied in drills below the seed or seed pieces. Bean and corn plants were more susceptible to injury than potatoes. Applications of anhydrous borax at the rate of 3 lbs. per acre was the largest amount that could be applied with safety in drills to beans. The limit for corn was somewhat under 5 lbs. and for potatoes slightly above 5 lbs. Applications of lime prevented some of the injury to all three crops, while gypsum and manure were also beneficial with corn.

AGRICULTURAL BOTANY.

The distentive agencies in the growth of the cell, D. T. MacDOUGAL (*Soc. Expt. Biol. and Med. Proc., 19 (1921), No. 3, pp. 103-110*).—Experimentation during five years shows that substances known to accelerate or facilitate growth also carry the hydration of living and dead cell masses and of pentosan protein colloidal masses to a point beyond that which may occur in pure water. The hydration reactions of living cell masses, of dried tissues, and of plates of colloids simulating the composition of living matter having been determined, attention was turned to experiments which might afford a means of estimation of the action of such material in the vacuolated cell.

It is concluded that all substances which may appear in the cell in the colloidal condition of reversible gels must be taken into account in any adequate interpretation of cell action, particularly growth. Albumin, pentosans, soaps, and lipins are thus to be taken into consideration in cell mechanics. The actual identity of living matter is not a question of structure but is one of integrated action, not one of equilibria but of energetics. All attempts to find separable membranes to protoplasts by dissection and by microscopic and ultramicroscopic methods has ended negatively. All of the substances known to promote growth which have been tested have been found to

accelerate hydration in living cells, dead cell masses, and protein pentosan—soap jellies at particularized concentrations from 0.01 to 0.00001M and through a range of pH from 4 to 11. Such action would represent the action of young cells. The second phase of growth of the cell is accompanied by the synergetic formation of vacuoles setting up conditions which have hitherto been interpreted in terms of osmotic equilibria. Some new interpretations seem to be required by facts presented.

The attempt is recorded to make up and operate an artificial cell, the outer wall of which should be a fixed colloid of clay, wood, or parchment, and a lining or plasmatic layer of reversible gel, simulating protoplasm, with a view to obtaining information as to the accumulation of electrolytes in the cell with resultant overbalancing osmotic potentials. Such cells filled with water and immersed in water show an intake and excretion for a continuous period of 60 to 80 days at 15° C., during which time the vacuolar content of the cell is replaced two or three times.

The course of metabolism, the action of light, and the transpiration of water may be held to account for the concentration of carbohydrates and electrolytes and the conversion of sugars and proteins to more highly osmotically active forms in leaves and other organs. There occurs in many tracts of the plant an accumulation of material in which diffusion or excretion may be said to work against osmosis after the general manner illustrated by glandular action in animals. The use of the artificial cell promises results of interest in the solution of such problems.

Direct and indirect determinations of permeability, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 4 (1922), No. 3, pp. 275-283, fig. 1).—Lack of direct and satisfactory means of determining the penetration of substances into the living cell has greatly hampered the study of permeability.

Methods for obtaining cell sap from *Nitella* without contamination are described. Tests of the cell sap show that in a balanced solution of NaNO_3 plus $\text{Ca}(\text{NO}_3)_2$ there is a slow penetration of NO_3 and the cell remains in a normal condition, but in pure NaNO_3 there is rapid penetration accompanied by injury. Inasmuch as determinations of electrical conductivity give the same result, it may be concluded that this method gives reliable information regarding permeability. While observations on recovery from plasmolysis give similar results, the method is less satisfactory.

The penetration of cations into living cells, M. M. BROOKS (*Jour. Gen. Physiol.*, 4 (1922), No. 3, pp. 347-349).—Direct tests of the cell sap of *Nitella* show that the protoplasm is normally permeable to Li, Cs, and Sr, and that penetration is more rapid in an unbalanced than in a balanced solution.

The origin of the electrical charges of colloidal particles and of living tissues, J. LOEB (*Jour. Gen. Physiol.*, 4 (1922), No. 3, pp. 351-371).—When a solution of a salt of gelatin or crystalline egg albumin is separated by a cation membrane from a watery solution (free from protein) a potential difference is set up across the membrane, in which the protein is positively charged in the case of protein-acid salts and negatively charged in the case of metal proteinates. The turning point is the isoelectric point of the protein.

"Measurements of the pH of the (inside) protein solution and of the outside watery solution show that when equilibrium is established the value pH inside minus pH outside is positive in the case of protein-acid salts and negative in the case of metal proteinates. . . . At the isoelectric point where the electrical charge is zero the value of pH inside minus pH outside becomes also zero. It is shown that a potential difference is established between suspended particles of powdered gelatin and the surrounding watery solution, and that the

sign of charge of the particles is positive when they contain gelatin-acid salts while it is negative when the powdered particles contain metal gelatinates. . . .

"Measurements of the pH inside the powdered particles and of the pH in the outside watery solution show that when equilibrium is established the value pH inside minus pH outside is positive when the powdered particles contain a gelatin-acid salt, while the value pH inside minus pH outside is negative when the powdered particles contain Na gelatinates. At the isoelectric point the value pH inside minus pH outside is zero.

"The addition of neutral salts depresses the electrical charge of the powdered particles of protein-acid salts. It is shown that the addition of salts to a suspension of powdered particles of gelatin chlorid also diminishes the value of pH inside minus pH outside. . . .

"All these measurements prove that the electrical charges of suspended particles of protein are determined exclusively by the Donnan equilibrium."

The physiological rôle of anthocyan. S. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 21, pp. 1311-1313).—In contrast to questions of origin, formation, and formative conditions as regards anthocyan, most of which problems have been attacked with some success, the question of physiological rôle remains to date almost completely unsolved, though certain contrasted views by different authors are cited herein.

Experimentation was carried out by the author with wheat and buckwheat plantlets developed in darkness to a length of from 3 to 5 cm., then exposed to light during 48 hours, and afterwards to darkness during periods ranging from 6 to 15 days under observation, after which they were subjected to chemical analysis. The results of such analysis are tabulated for both plants as regards glucosids, sugars (reducing and nonreducing), starch, and cellulose.

From the data presented it is concluded that in both wheat and buckwheat which had formed anthocyan pigments in light and which were afterwards kept in darkness, the anthocyan and flavonic glucosids decreased sensibly in proportion to the length of the period of darkness. A considerable portion of the sum total disappeared under such conditions.

Studies on the physiological rôle of saponin. A. MOYCHO (*Rev. Gen. Bot.*, 32 (1920), No. 383, pp. 449-459).—Studies involving the same technique and plants as reported by Korsakoff (*E. S. R.*, 33, p. 524) have been carried on, with the result that during the vegetative development of *Saponaria officinalis* the saponin content of the roots remained constant, later decreasing and remaining low during the formation of bloom and seeds, and then increasing progressively. The results from *Agrostemma githago* agreed with those reported by Korsakoff.

The effect of the accessory substances of plant tissue upon growth of bacteria. O. T. AVERY and H. J. MORGAN (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 3, pp. 113, 114).—It appears that the presence in media of certain substances contained in fresh plant tissues not only supplies the necessary factors for growth of the hemoglobinophilic bacilli but furnishes also the requirements for the cultivation of other bacteria which multiply only under certain restricted conditions. One of these is the reaction of the media which in the presence of plant tissue may be made to vary over a much wider zone without retarding growth; another is oxygen tension which similarly seems to require for sensitive organisms much less accurate control in the presence of plant tissue than in its absence.

The exact nature of the substances contained in plant tissue upon which these properties depend is not yet determined. The studies so far made, how-

ever, suggest that they are related to the presence of certain oxidizing and reducing enzymes in fresh plant tissues as well as to the presence of so-called accessory food substances.

The effects of radium rays on metabolism and growth in seeds. A. C. REDFIELD and E. M. BRIGHT (*Jour. Gen. Physiol.*, 4 (1922), No. 3, pp. 297-301).—The authors have carried out a series of experiments designed to test the effect on radish seed of β -rays of radium on those metabolic processes which result in the production of carbon dioxide, and to demonstrate whether any correlation exists between alterations produced in these activities and the ability of the protoplasm to take part in cell division and growth.

The output of CO_2 given off before germination had time to take place was measured in the apparatus described by Osterhout (*E. S. R.*, 41, p. 524). The data are presented in tabular form, the results indicating that no direct relation exists between the effect of β -rays on CO_2 metabolism and growth in radish seeds. The important point demonstrated by the present experiments, in contrast with others indicated, is that the changes in the rates of CO_2 production and cell division do not always go hand in hand; one may be increased by exposures which retard the other.

It is because radiations have a specific action on certain physiological processes, in contrast to others, that their characteristic effects are produced. Consequently it is regarded as unjustifiable to make any general assumption concerning their action on the chemical changes of living matter as a whole.

Comparative studies on respiration.—XIX, A preliminary stage in the progress of ether anesthesia, E. P. SMITH (*Jour. Gen. Physiol.*, 4 (1921), No. 2, pp. 157-162, figs. 2).—The method employed in these experiments was that described by Osterhout (*E. S. R.*, 41, p. 524). The material used was wheat of a pure strain, uniform in growth, viable, easy to grow, and very constant as to results.

From the results as presented descriptively and graphically, the author concludes that the first effect of ether is to cause a depression in the rate of respiration. This is followed by a rapid rise above normal, which in turn is succeeded by a fall. With the concentrations used (1, 3.65, and 7.3 per cent) the respiration is ultimately reduced to approximately the same level, the time required for this result being less for the stronger concentrations. Recovery is possible after removal from the ether even in cases when respiration has been brought somewhat below normal.

Comparative studies on respiration.—XX, The cause of partial recovery, O. L. INMAN (*Jour. Gen. Physiol.*, 4 (1921), No. 2, pp. 171-175, figs. 2).—The author finds that the respiration of *Chlorella* is diminished by exposure to hypertonic salt solutions. After a short exposure there is complete recovery when the algae are removed to the normal medium. After a longer exposure recovery may be incomplete, though staining with methylene blue indicates that few, or none, of the cells are killed as the result of the exposure. It would seem, therefore, that this treatment produces a persistent lowering of the rate of metabolism. Such a condition of metabolism is also found after exposure to chloroform.

The biology of *Goodyera repens*, J. COSTANTIN and L. DUFOUR (*Rev. Gén. Bot.*, 32 (1920), No. 384, pp. 529-533).—In the Forest of Fontainebleau, *G. repens*, thought to have been introduced about 1854, shows the presence of a saprophytic and apparently symbiotic fungus, supposedly a new species and described herein as *Rhizoctonia goodyerae repentis*.

Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from July 1, 1917, to Decem-

ber 31, 1918 (*U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos. 52 (1922), pp. 55, pls. 4; 53, pp. 86, pls. 4, fig. 1; 54, pp. 56, pls. 4; 55, pp. 48, pls. 5, figs. 2; 56, pp. 34, pls. 6; 57, pp. 54, pls. 4*).—Descriptions and economic notes are given of more than 2,000 introductions of seeds and plants made between July 1, 1917, and December 31, 1918.

FIELD CROPS.

[**Report of field crops work in Georgia, 1921**] (*Georgia Sta. Rpt. 1921, pp. 6-8, 15*).—Garrikk led corn varieties with 29.8 bu. per acre. Applying all the fertilizer to corn when knee high gave the best results, placing all under at planting followed in effectiveness, while broadcasting gave the poorest yields of the methods tested. Plats of corn top-dressed with 400 lbs. of 8-4-3.5 fertilizer, with sodium nitrate, acid phosphate, and with kainit in the same amounts as contained in the fertilizer, gave indications that most of the benefit from top-dressing with a complete fertilizer comes from the nitrate contained.

College No. 1 headed the cotton varieties and seems to give promise for boll weevil conditions. A plat dusted five times with calcium arsenate gave an increase of 254 lbs. of seed cotton per acre over the untreated plat, which about paid for the cost of treatment. Cotton spaced 8 and 12 in. apart gave the best results, while late thinning did not prove better than thinning at the regular time. When fertilizers analyzing 8-0 3, 8-1-3, 8 2-3, 8 3-3, 8-4-3, and 8 5-3 were applied to as many different plats at the rate of 400 lbs. per acre, a steady increase in yield took place with the increase of nitrogen up to 3 per cent, but thereafter a slight decrease was noted. With applications of 600 lbs. of fertilizer per acre with 8 per cent of phosphoric acid and 3 per cent of nitrogen in every case, and the potash varying from 0 to 9 per cent, a gradual increase in yield occurred up to 4 per cent potash when a decrease began. Acid phosphate applied at rates of from 50 to 500 lbs. per acre on plats receiving equal amounts of potash and nitrogen with rye turned under as green manure, appeared to have no effect on the yield, plats without phosphate producing equally as well. The most profitable yield was obtained with 200 lbs. of an 8-3-3 fertilizer, which gave an increase of 274 lbs. of seed cotton. An 800-lb. application actually decreased the yield when compared with 200 lbs., producing a much larger stalk with less cotton.

Considering the production of cotton by nitrogen in the form of sodium nitrate at 100, the nitrogen in the form of sodium nitrate and cottonseed meal produced 114.7, ammonium sulphate 101, velvet bean meal 100, cottonseed meal 100, sodium nitrate and ammonium sulphate 93.7, dried blood 86.8, Nitropo 83, and peanut meal 75.9.

Top-dressing oats with sodium nitrate increased the yield 70 per cent, and ammonium sulphate was proved to be 90 per cent as available as sodium nitrate for this purpose. The maximum yield of sweet potatoes was secured from an application of 8-8-3 fertilizer.

[**Report of field crops work in Louisiana, 1921**], W. G. TAGGART, A. F. KIDDER, and G. D. CAIN (*Louisiana Stas. Rpt. 1921, pp. 5, 6, 9-11, 12*).—The further progress of earlier work (*E. S. R., 45, p. 223*) is described.

In experiments with sugar cane at the Sugar Experiment Station ammonium nitrate gave highly profitable returns and was followed closely by calcium cyanamid, nitrate of soda, and sulphate of ammonia. Cottonseed meal gave better returns than tankage, and 72 lbs. of phosphoric acid apparently produced more than 36 lbs. Results with clovers on fall plant cane showed the necessity of inoculating cleaned sweet clover seed but not seed in the hull. Crimson clover planted on fall plant cane smothered the cane and is recom-

mended for a fall cover crop. L 511 cane again showed a high sucrose content and resistance to mosaic, but its tonnage was extremely disappointing.

At Baton Rouge the use of cottonseed meal and acid phosphate with organic matter doubled the yield of corn in continuous cultivation over that obtained by these materials without organic matter. Velvet beans in a 2-year rotation, oats, and legumes, gave more cotton than did either soy beans or cowpeas. Considerably more cotton was produced in a 2-year rotation of corn and cotton with soy beans in the corn than in the same rotation omitting soy beans. Where both velvet beans and corn were planted in the same row, the yields were considerably larger and without noticeably greater damage in the corn than where beans were in alternate rows or every third row. Continuous cotton did not make enough to pay for the picking. Breeding and selection work was continued with cotton, corn, and oats.

Prolific corn varieties slightly outyielded the other varieties at the North Louisiana Station. The leading cotton varieties included Cleveland strains, Tri-Cook, Dixie-Triumph, Deltatype Webber 8985, Webber 49-4, and Express. Arlington and Virginia soy beans made the largest yields for hay and seemed to produce the largest amount of grain of the new varieties tested.

[**Report of field crops work at South Mississippi Substation, 1921**], E. B. FERRIS and F. B. RICHARDSON (*Mississippi Sta. Bul. 201 (1922)*, pp. 3-13, 14, 16, 18).—The progress is reported of work along the same general lines as heretofore (E. S. R., 45, p. 223). Results of fertilizer trials with corn, cotton, and sweet potatoes are tabulated and discussed. A selection of Lone Star cotton with 1,980 lbs. of seed cotton led in yields, while Foster 6102 was first in money value per acre. Cotton spaced 6 in. in the drill outyielded that at 12 and 24-in. distances. Hastings Prolific produced the highest yields of first grade corn per acre among 20 varieties of corn tested. Porto Rico sweet potatoes outyielded Triumph and Nancy Hall, and Japanese Seeded Ribbon cane proved much superior to Gooseneck sorghum. Notes are also given on bur and other clovers, hairy vetch, lespedeza, and carpet grass.

[**Report of field crops work at Holly Springs, Miss., Substation, 1921**], C. T. AMES (*Mississippi Sta. Bul. 202 (1921)*, pp. 6-27, figs. 8).—Continuation of work similar to that reported earlier (E. S. R., 45, p. 126) is described, including variety tests with cotton, corn, and sweet potatoes. Cultural directions are briefly outlined for cotton, sweet potatoes, alfalfa, and miscellaneous forage crops. The fertilizer experiments with cotton gave indications that a mixture of 200 lbs. acid phosphate and 100 lbs. sodium nitrate, or its equivalent in other forms of nitrogen, about meets the requirements of the brown loam soils. Results of spacing trials suggest 3-ft. rows on thin upland and not over 3.5-ft. rows on valley land, with 2 stalks every foot, for the best yields.

Although an unfavorable season rendered a fertilizer and bean test with corn rather inconclusive, an application of both acid phosphate and sodium nitrate applied at planting apparently gave the best results. Beans grown in the corn reduced the yield of the latter only slightly. It is deemed advisable to plant velvet beans between the rows after corn is 6 to 8 in. in height in 5.5-ft. rows, while other beans should be planted at the same time as the corn.

[**Report of field crops work in New Hampshire, 1920-1921**] (*New Hampshire Sta. Bul. 203 (1922)*, pp. 16, 17, 18).—Experiments with field crops were continued by F. W. Taylor and M. G. Eastman as heretofore (E. S. R., 46, p. 328).

Sunflowers are indicated as a good substitute for corn where the latter can not be grown successfully, making 22.6 tons per acre, or 70 per cent more than the average of corn varieties. The leaves and stems of inoculated soy beans

contained 2.26 per cent of nitrogen as compared with 1.79 in the uninoculated beans. Early plantings of silage corn, in cooperation with the U. S. Department of Agriculture, did not appear to be noticeably better for silage than later plantings. Variety tests of silage corn are also reported.

[Report of field crops work in Pennsylvania] (*Pennsylvania Sta. Bul.* 170 (1922), pp. 7-10).—Leading varieties in the small-grain tests included Fourth of July, Big Four, Japan, Golden Rain, Victory, and Sixty Day oats, Charlotte-town barley, and Blue Ribbon spring wheat. A selection of Fulcaster winter wheat, designated as Pennsylvania 44, has been noted in detail (E. S. R., 46, p. 397). The findings to date of a wheat survey indicate that Fulcaster and others of its type are by far the most commonly grown, with China, Diehl-Mediterranean, Leap, and Red Wave of some prominence. Over half of the wheat is bearded and nearly all is red grained.

Corn varieties are recommended for the various sections of the State.

The best two strains of timothy derived from seedlings from choice mother plants have outyielded commercial timothy by an average of 715 and 835 lbs. of hay per acre, respectively.

The Rural group maintained its supremacy in potato variety tests as the best group of potatoes for Pennsylvania. Sun sprouting did not give significant increases in yield.

Manure and complete fertilizer gave the highest yields and the best turfs on permanent pasture. The use of fertilizer, especially nitrogen in the form of sodium nitrate, increased the stand and vigor of Kentucky blue grass. White clover was most abundant and vigorous on plats receiving complete fertilizer or manure.

The best producers of alfalfa hay have been the Baltic, Cossack, and Grimm strains of the variegated group and California-grown seed of the common group. Peruvian alfalfa and common alfalfa from Chile-grown seed were badly winterkilled, but the other strains suffered little injury. Turkestan alfalfa has given yields considerably lower than seed of common and variegated alfalfas grown in this country.

[Field crops] work of the San Antonio Experiment Farm in 1919 and 1920, G. T. RATLIFF (U. S. Dept. Agr., *Dept. Circ.* 209 (1922), pp. 9-32, 33, 34).—Continuing previous work (E. S. R., 43, p. 134), the 1919 yields of all crops in rotation except cotton greatly exceeded the average yields for the period 1909-1920. In 1920, all crops with the exception of dwarf milo gave fair to excellent yields. Rotation has given higher yields than continuous cropping in spite of the very fertile soil. The increase in yield was not so great in years of good rainfall, but the advantage in the control of weed pests was greater. The value of the early preparation of land was plainly demonstrated.

The use of about 16 tons of barnyard manure per acre has increased the yields of cotton, milo, and hay sorghums. Oats for hay have given practically equal yields from manured and unmanured plats, whereas observations of rotations including oats for grain with manure indicate that invariably the application of manure decreases the grain yield by encouraging excessive plant growth, especially in years of low rainfall. Although average yields for crops in general are slightly in favor of manuring, the benefits are held insignificant and the increased returns have not justified the practice where additional expense is incurred. The use of rye, cowpeas, and field peas for green manure was not justified by increased yields.

The results of 1919 and 1920 substantiate previous conclusions regarding the futility of subsoiling. Plats bordered with a bank of earth to prevent run-off of rain water did not retain more moisture than did those without borders, and

nothing has been indicated by the experiments that would justify the additional expense.

Corn and cotton under biennial cropping showed decreases in yields as compared with continuous cropping in experiments carried on since 1910, while the reverse was noted with oats and sorghum. For crop production in the San Antonio region a long period of fallow does not appear to be warranted.

In tests reported by H. G. McKeever, Kasch ranked first in yield among cotton varieties, but Acala, a close second with fiber from $1\frac{1}{4}$ to $1\frac{1}{8}$ in. in length, was greater in indicated money value. The results of cultural experiments indicate that with a season at all favorable for cotton the yield can be materially increased by leaving the plants close together in the row. This close spacing increases the chances of making a crop either by setting the bolls before the weevils become very numerous or when weevils destroy all of the first squares, by the greater drought-resistant qualities of the single-stalk plant.

Comparisons by E. B. Brown of 34 varieties of corn from southern and southwestern sources, ranging from very early to very late in maturity, demonstrated the greater average productiveness under continuing favorable conditions of the late maturing varieties as compared with earlier varieties. Alternate interplanting of early and late maturing varieties showed no material decrease in yields in 1919 and increases in drier seasons, and the method seems of value for general application in the region. At spacings of 8, 12, 14, 16, and 22 sq. ft. per plant in 1919, a prolific variety gave 17, 26, 32, 17, and 50 per cent increases in yield per plant over a single-ear variety, demonstrating its greater efficiency in adjusting itself to different spacings. Both single-ear and prolific varieties made their maximum yields at spacings 8 sq. ft. per plant in 1919 and at 4.1 sq. ft. in 1920. The single-ear type outyielded the prolific by 1 bu. per acre at the 4.1 sq. ft. spacing, but it was outyielded at the other spacings by from 2 to 10 bu. No material yield differences were shown between plats of corn with cowpeas between the rows and those of similar row spacing but not interplanted. The yields and stands varied inversely as the distance between rows.

Sumac sorghum made the highest forage yield in 1919, 7,950 lbs. per acre, while dwarf hegari made only a little over 2 tons. Limited experiments with small grains are also described.

Amraoti field peas gave the maximum grain yield, or 34 bu. per acre, while Fraile, which produced only 10 bu. of seed, made the most hay, 2.85 tons. For grain the optimum rate of seeding field peas is about 90 lbs. per acre under such seasonal conditions as in 1919. For hay or green manure, not more than 50 lbs. of seed need be used.

In variety tests with flax since 1915 the maximum yields have varied from 3.48 to 15.4 bu. per acre, and profitable yields were secured only in 1919.

Observations of plantings of Rhodes grass show the difficulty of obtaining a satisfactory stand from a first seeding, probably to be remedied by allowing the first crop to mature seed before harvesting. Maximum yields may be expected from stands two years old. Cured hay is relished by milch cows and work animals less than Sudan or well-cured sorghum hay. The cost of the seed and uncertainty of a stand do not recommend the general use of Rhodes grass as a hay crop in the immediate region.

[Report of field crops work in Wisconsin, 1920-21] (*Wisconsin Sta. Bul.* 339 (1922), pp. 19, 87-112, 113, 114, figs. 11).—Further progress of experiments with field crops (*E. S. R.*, 45, p. 226) is reported.

Inoculated canning peas on a highly fertile silt loam, in studies by O. C. Bryan, showed increases in total weight of plant and in nitrogen content of

tops, while the weights of pods and peas were the same as on uninoculated plats.

Mixtures of alfalfa and timothy, seeded by L. F. Graber and N. T. Nelson in the proportion of 3:1, outyielded alfalfa alone for all cutting stages by nearly 1 ton per acre, or 25 per cent, the increase being entirely in the first cutting. Two cuttings of alfalfa alone in the full-bloom stage yielded the same, 4.4 tons, as three cuttings in $\frac{1}{2}$ bloom, but with hay somewhat inferior in quality. Two cuttings of the mixture in full bloom gave 0.4 ton more hay than three cuttings in $\frac{1}{2}$ bloom. Two crops of rather coarse woody or stemmy hay secured from alfalfa alone, cut during the seed stage, amounted to 0.5 ton less than two crops from the full bloom stage. The seed stage with the alfalfa-timothy mixture produced two crops of coarse hay, with a greater amount of timothy in the first crop than in any of the earlier cuttings.

E. J. Delwiche found that, compared with the parent strain, the seed yield of the pedigreed strains of Manchuria soy beans has been increased from 19 to 96 per cent, although the date of maturity was not altered. In spite of the unusually long and hot season at Marshfield and Spooner, early types produced more seed than the late kinds and equaled them in hay production. The eighth year of breeding soy bean selections for increased oil content showed E. W. Lindstrom that the high and low line strains gave iodine indices of 134 and 125, respectively, as compared with 180 for linseed oil on the same basis. Selection within either line failed to change the quality of the oil. The impurity of the variety at the time the experiment began is held responsible for the original effect of selection. Continued selection for a higher quality of oil is probably useless when once a pure line of soy beans has been bred, and hybridization or the continued analysis of new strains are suggested for the further increase of quality. Five years' data on the relation between quality and amount of oil in the plant show that the increase in quality was accompanied by a very slight decrease in the quantity or percentage of oil.

In 1921 Sudan grass seeded as late as July was nearly headed out and fit to make into hay by the latter part of August, according to G. B. Mortimer. Sudan in a normal sand made an excellent smother crop, and quack grass was eradicated successfully in two infested fields. Twenty or 25 lbs. of good seed gave the best results either broadcasted or drilled. Plats seeded with 10 lbs. of Sudan per acre with 1.5 bu. of soy beans of the varieties Medium Early Green, Manchur, Ito San, and Wisconsin Early Black averaged 4.1, 4.3, 4.6, and 3.5 tons of cured hay composed of 17.5, 23, 29, and 42 per cent, respectively, of soy beans. A 1.5 bu. rate of seeding was found best for soy beans.

Canadian Alborea sweet clover, secured by R. A. Moore, proved much finer in stem and more leafy than biennial white sweet clover and yielded 12 bu. of seed per acre. All field tests with Hubam sweet clover were failures, and the weeds grew so abundantly that the clover did not even make good hay. Tests by H. W. Albertz suggest kudzu to be of promise as a forage plant.

Investigations by E. D. Holden demonstrate that sunflowers can be grown successfully under almost any climatic and soil conditions in the State, and with a larger tonnage of green material than any other silage crop. Silage from sunflowers in $\frac{1}{2}$ bloom were somewhat more acid than corn silage from the same field and contained considerable fibrous woody material. Fed on a part ration of the silage, cows were gradually induced to clean up more of it, but they did not eat it readily and picked out the corn in the mixture. Silage from sunflowers in full bloom proved unpalatable and of poor quality, and cows ate it sparingly and fell off in milk production, whereas silage from a cutting with only a few plants blooming was eaten readily and without decrease in milk flow. It is stated that much of the evil effect of sunflower

blight may be prevented by early cutting. The best quality of silage has been obtained from a spacing of not less than 6 in. in the drilled row. Corn and sunflowers drilled together in rows at the Marshfield Substation in proportions of 1:1, 2:1, and 3:1 by volume produced 11.5, 12.3, and 10.7 tons per acre, respectively, as compared with 11.5 tons from all sunflowers. Sunflowers broadcasted on fallow at 45 lbs. per acre early in June grew exceedingly dense, and in July and August the ground was found absolutely bare of other vegetation, proving the value of sunflowers as a smother crop.

Cold-resistant corn obtained by B. D. Leith by germinating in an ice box can be planted from 10 to 14 days earlier than ordinary corn. Results of time of planting tests at Spooner seemed to indicate that early varieties produce larger yields when planted late, provided the frost is later in the fall.

Seven-year averages with wheat, oats, and barley show no advantage of drilling over broadcasting. Work with oats has been noted (E. S. R., 47, p. 335).

Clover variety tests showed conclusively that imported red clover, at least from regions of mild winters, does not withstand Wisconsin winters. Red clover originally imported from Europe, but long grown in America, has become acclimated undoubtedly through the survival of the hardiest plants.

At Marshfield, Delwiche found a pedigreed Early Java spring wheat to yield 16.5 bu. per acre, while Marquis made only 6.7 bu., and at Ashland it was much more resistant to stem rust than other varieties, having 77 per cent of clean stems, as compared with common Early Java 35 per cent, Marquis 40, life 35, and durum 25 per cent. The five highest yielding wheats at Ashland were all hard winter varieties of the bearded type, making from 30.4 to 26.8 bu. per acre. Winter wheat continues to maintain higher yields than spring wheat, the 9-year average of Marquis being 23.2 bu., while pedigreed selections of Turkey Red and Bacska made 37.2 and 35.9 bu., respectively. Tests on time and rate of seeding winter wheat by Leith recommend fall planting of winter wheat in the latitude of Madison as late as the last week in September. One bushel of seed per acre appears adequate.

Work with hemp by A. H. Wright, in cooperation with the Office of Fiber Investigations, U. S. D. A., was continued. During 1921, Wisconsin produced three-fourths of the hemp fiber of the United States. Eight thousand acres, more than 1,000 acres over the preceding year, were grown in the State, in spite of unfavorable conditions developed in connection with the crop of 1920.

Available data do not indicate that fiber flax has made a showing sufficient to warrant its commercial production on marsh soils. Investigation of fiber flax seed revealed no varieties of fiber flax which could be considered pure that are being grown on a commercial scale, although fiber flax is readily improved by selection. The pure strain Saginaw, which is superior in height, freedom from branching, purity, and resistance to lodging and disease, averaged about 40 in. in height in 1921, or from 6 to 12 in. higher than other strains of fiber flax grown commercially during the same season in other sections of the country, while the seed yield was 6 bu. per acre.

Breeding work with sorghums for sirup by Wright is also noted.

Summer tillage in Montana, C. McKEE (*Montana Sta. Circ. 102 (1922), pp. 4*).—The province of summer tillage and the reasons for the practice are specified, preparatory treatments for land to be summer tilled are offered, with suggestions for the care of summer-tilled land after plowing, and methods of seeding crops following summer tillage are briefly outlined.

Management of meadows and pastures, G. L. SCHUSTER (*Delaware Sta. Bul. 130 (1922), pp. 16, figs. 3*).—Seeding methods and management practices

are outlined for meadows and pastures, and mixtures are recommended for various land types.

The results of top-dressing experiments with grass and the hay yields in crop rotation tests, taken together with the cost of the fertilizer materials used, point to a top-dressing of 50 lbs. of muriate of potash with either 125 to 300 lbs. of acid phosphate or 100 to 150 lbs. of sodium nitrate per acre for the most economical returns on mixed clover and grass meadows or pastures. Where clover predominates in meadows in rotation, from 250 to 400 lbs. of acid phosphate and 50 to 100 lbs. of muriate of potash per acre is recommended. Where timothy and mixed grasses predominate, from 150 to 200 lbs. of sodium nitrate or 100 to 150 lbs. of ammonium sulphate with 50 to 150 lbs. of acid phosphate and 25 to 75 lbs. of muriate of potash per acre is advised. Liming is advised for increases in yield of hay and improvement of quality. "Every pasture is a problem by itself and will have to be treated according to the individual needs."

Silage crops for summer and winter feeding, M. E. McCOLLAM (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, pp. 17-19).—Crops and cultural methods are recommended for summer and winter silage.

Rate of seeding tests with Russian sunflowers suggest from 10 to 11 lbs. of seed per acre. No difference in palatability was observed when silage made from immature sunflowers, immature sunflowers and immature corn mixed in equal proportions, or sunflowers in full bloom was fed to cattle.

Alfalfa fertilizers (*New Mexico Sta. Rpt.* 1921, p. 28).—Although results indicated that manure is probably the fertilizer most needed for alfalfa on the heavy clay soils, 15 tons per acre did not effect an increase in yield over 7 tons sufficient to pay for the additional manure. Acid phosphate produced only slightly less hay than 7 tons of manure. Bone meal, sodium nitrate, and alfalfa meal showed the lowest yields for the two years tested, giving even less than the check plots.

Some phases of breeding work and seed production of Irish potatoes, W. J. YOUNG (*South Carolina Sta. Bul.* 240 (1922), pp. 20, figs. 4).—The further progress of breeding work with Irish potatoes (*E. S. R.*, 39, p. 534) is reported.

The failure to obtain seedlings approaching Lookout Mountain in seed production may be due to the fact that they have been grown only as a spring crop, i. e., at a season of the year when conditions are unfavorable for seed production. The fact that in the fall crop of Lookout Mountain vegetative growth was highly correlated with seed production and with yield of tubers, while a somewhat less degree of correlation was found between the seed production and yield of tubers, apparently indicates that the conditions favoring one character also favors the others and that no mutual antagonism exists between the several characters, rather than an inherent connection between the characters. Lookout Mountain is heterozygous with respect to floral color and shape and color of tubers, and apparently homozygous as to depth of eyes.

Failure to get seed may be due to hereditary sterility of the pollen, unfavorable environmental conditions, and the shedding of the blossoms, which is probably the manifestation of the first two causes. Conditions during the blooming season which probably favor seed production are a gradually declining temperature and especially cool nights. An average minimum temperature somewhat under 60° F. and a maximum temperature of about 75° seemed favorable. Temperature data for the months of September, 1918, 1919, and 1920 suggest that moderately cool weather, particularly at night, favors the setting of seed, and that a gradually falling temperature with moderate moisture is especially favorable.

Separation of the blossoms occurs about half an inch below the blossom at a point marked very early by a constriction of the stem, underneath which is a

layer of meristematic cells. Later the abscission layer becomes concave and a calluslike mass of tissue is formed. When the bud or blossom blasts, changes take place in the cells on the upper surface of this layer, so that the portion above is easily broken away and the callus quickly heals the exposed surface.

Potatoes in South Dakota, A. T. EVANS, G. JANSSEN, and M. FOWLES (*South Dakota Sta. Bul. 196 (1922)*, pp. 376-396, 410-415, figs. 9).—Cultural and field practices for the production of potatoes in South Dakota are suggested, together with results of experiments with the crop at the station and substations.

Varietal trials indicate that in general Early Ohios, Irish Cobblers, Rural New Yorkers, and Burbanks are best suited for South Dakota conditions.

Tests of selection methods indicate that hill selection will outyield select tuber plantings, and that the latter in turn will outyield bulk plantings. Large potatoes outyielded culls from the same stock with striking consistency, producing 44.2 per cent more in the Early Ohio and 49.2 per cent more in Carman No. 3. With both varieties the results coincide in favor of the large seed piece over all others and the medium seed piece over the smaller.

Plats of Irish Cobbler at Highmore plowed 6 and 12 in. deep averaged 64.2 and 61.2 bu. per acre, respectively, during the period from 1915 to 1921, inclusive. The results of date of seeding tests at Highmore show May 15 to be the best date for planting in that locality. Thirty-inch hilling outyielded its nearest drilled competitor, 42 by 12 in., and its nearest hilled competitor, 36 in., by 13.2 per cent each.

Shelling percentage in grain sorghum, A. B. CONNER and R. E. KARPEN (*Texas Sta. Bul. 294 (1922)*, pp. 3-11, figs. 2).—The grain content of grain sorghum heads in experiments at the Lubbock Substation during 1916 to 1921, inclusive, averaged in feterita 75.2 per cent, kaoliang 74.5, white milo 74, blackhull kafir 73.1, red kafir 72.7, yellow milo 71, darso 70.7, Schrock kafir 69.9, and pink kafir 69.5 per cent, or from 1,504 to 1,390 lbs. of grain per ton of heads. Individual strains within a class varied considerably, indicating the possibility of producing higher grain-bearing strains. Although the rates of seeding embraced in the experiments, 3 to 36 in. between plants in the row, had little effect on the percentage of grain in the heads, the opposite reactions of kafir and milo in respect to shelling percentages when grown at varying spacing in the row indicate that kafir is better adapted to thick seeding than milo as far as concerns shelling percentage. Milo showed much wider annual variation in shelling percentage than kafir.

Effect of different reactions on the growth and nodule formation of soy beans, O. C. BRYAN (*Soil Sci., 13 (1922)*, No. 4, pp. 271-302, figs. 15).—A study was made at the University of Wisconsin of the influence of acidity and alkalinity on growth and inoculation of soy beans in solution and sand cultures.

Shive's nutrient solution favored the growth and inoculation of soy beans in sand cultures but not in solution cultures. Crone's nutrient solution was favorable for growth and inoculation in both solution and sand cultures.

The reaction of the nutrient solution in contact with growing plants did not remain constant very long, unless the initial reaction of the solution was the optimum for the plants. The rate of change in reaction was greater in the alkaline range than in the acid range. Plants growing rapidly apparently influence this rate of change rather than slow growing plants. The most favorable reaction for growth and inoculation of soy beans was pH 6.5. The limits within which inoculation took place were about pH 4.6 and 8, and the limits for growth of soy beans were about pH 3.9 and 9.6. The critical H-ion concentration for nodule formation of soy beans was slightly less than that for plant growth. The different strains of soy bean bacteria showed small differences in regard to critical H-ion concentration.

Corn grew at a greater acidity and alkalinity than the soy bean or cowpea. The data indicated that the cowpea apparently has a greater range of reaction at which nodules are formed than the soy bean. The reaction of plant juices varied with the degree of acidity or alkalinity at which the plants were grown, except that the juice of the corn leaves showed little change. The juices of the roots followed the reaction of the media more closely than did the juices of the leaves.

Sweet clover, C. R. MEGEE (*Michigan Sta. Spec. Bul. 113* (1922), pp. 14, figs. 6).—The desirable qualities of biennial white sweet clover are pointed out, and practices considered profitable in the production of hay and seed are recommended. Fertilizer trials with the crop have been noted (E. S. R., 46, p. 518).

A test at the station indicates that sweet clover should be cut just before the blossom buds appear and when from 6 to 8 in. in height, or high enough so that a few leaves will be left on the stubble. Extension mower shoe soles, designed for leaving a 6 to 8 in. stubble, are illustrated.

Sweet potato storage studies, H. C. THOMPSON, J. H. BEATTIE, ET AL. (*U. S. Dept. Agr. Bul. 1063* (1922), pp. 18, figs. 4).—Experimental work on methods of sweet potato storage, carried on from 1912 to 1921, is described.

With careful handling the shrinkage ranged from 5 to 9.39 per cent, averaging 7.52 per cent, where shrinkage under commercial handling varied from 7.4 to 20.4 per cent and averaged 10 per cent. Decay amounted to 0.45 per cent under careful handling and 3 per cent under commercial handling. Sweet potatoes stored in houses lost from 0.5 to 2 per cent from decay, while those stored in banks and pits showed losses of from 4 to 40 per cent. Those injured in harvesting and handling lost 28.13 per cent by shrinkage, and stock that was carefully handled lost 13.83 per cent. Sweet potatoes sorted from time to time during the storage period showed greater losses from decay than those not sorted.

Storage tests with single crates of each of the important varieties of sweet potatoes showed the shrinkage during the curing period (20 days) to vary from 6.07 to 10.27 per cent. The average loss in weight for all varieties for the storage period (160 days) was 16.52 per cent. Sweet potatoes stored at 50 to 55° F., 55 to 60°, and at 60 to 65° lost 13.83, 15.27, and 15.7 per cent in weight, respectively. Sweet potatoes of the Nancy Hall, Southern Queen, and Big-Stem Jersey varieties stored in crates showed greater shrinkage than when stored in bins. The average temperature in bins filled with sweet potatoes was higher than that of the surrounding air. When stored in bins under uniform conditions Southern Queen showed the least decay, Porto Rico and Nancy Hall were about equal, and Big-Stem Jersey decayed the most of the four. Nancy Hall was the lowest in shrinkage, Southern Queen next, Porto Rico next, and Big-Stem Jersey was highest.

Tobacco investigation [in] Lancaster and Clinton Counties (*Pennsylvania Sta. Bul. 170* (1922), pp. 23, 24).—Various experiments with tobacco were conducted as heretofore (E. S. R., 44, p. 735). When used as supplements to barnyard manure, muriate of potash was found injurious to the burn of the leaf, whereas the sulphate was beneficial. Within certain limits, sulphate of soda could be substituted for sulphate of potash.

Garlic and other factors influencing grades of wheat, J. E. METZGER (*Maryland Sta. Bul. 246* (1922), pp. 99–116, figs. 3).—Analyses of samples of wheat of the 1920 and 1921 crops gathered in surveys of Maryland, in co-operation with the U. S. Department of Agriculture, are tabulated, and discussion is given of the relative influence of moisture content, weight per bushel,

foreign material, and garlic content in lowering the market grade of wheat. Practices for eradication of garlic are outlined.

Of the samples tested 81.4 per cent graded No. 3 or lower on account of moisture alone. Weight per bushel was the determining grade factor in only 3.4 per cent of the samples of newly threshed wheat and in 6.4 per cent of the old wheat. Corn cockle and rye sufficient to affect the grades were found in about 75 per cent of the samples. Only 6.4 per cent of the 1920 crop samples contained as few as 10 garlic bulblets or less, but 24.5 per cent of the 1921 crop samples contained less than 10 bulblets per 1,000 gm. In both surveys the bulk of the garlic was found in the samples of the lowest grade.

The test weight of grain: A simple method of determining the accuracy of the testing apparatus. E. G. BOERNER and E. H. ROPES (*U. S. Dept. Agr. Bul. 1065 (1922), pp. 13, figs. 8*).—The "test weight per bushel" is the weight of the volume of grain required to fill level full a Winchester bushel measure of 2,150.42 cu. in. capacity, and should not be confused with the "legal bushel," which is based on weight instead of measure or volume. This publication describes apparatus for taking the test weight (*E. S. R., 36, p. 441*), points out the causes of variations in making weight-per-bushel determinations, enumerates special points to observe in making correct weight-per-bushel tests, and outlines methods of determining accuracy of the test kettle and the accuracy and sensitiveness of the beam.

Commercial agricultural seeds, 1921, compiled by W. J. MORSE (*Maine Sta. Off. Insp. 102 (1921), pp. 82-93*).—Results of examinations of official samples of agricultural seeds in 1921 are tabulated.

Results of seed and legume inoculant inspection for 1921, J. G. FISKE (*New Jersey Stas. Bul. 360 (1922), pp. 5-37*).—Tables show the purity and germination of about 340 official samples of seed tested during the year ended July 1, 1921. Results of analyses of 34 official samples of legume inoculants are also given.

The blueweed and its eradication. R. E. KARPEN (*Texas Sta. Bul. 292 (1922), pp. 3-18, figs. 5*).—The blueweed (*Helianthus ciliaris*), a perennial propagated largely from the persistent underground stems, is a native in parts of west and southwest Texas, where it grows inconspicuously in the sod to become a troublesome pest when the land is put into cultivation. The weed produces a large seed crop, but reproduction in this way is very limited, repeated tests having shown only about 1 per cent germination. The seed required a long time to germinate and sprouted at very irregular intervals.

Experiments in eradicating the blueweed have shown conclusively that it can be killed out completely in less than two seasons by plowing at intervals of about two months during the growing season. Plowing 7 in. deep proved more efficient than 4 in. deep. Listing deep or shallow or cutting the weeds at the surface with a hoe or other implement were ineffective in comparison with thorough plowing. A combination of deep plowing, smother crops, and clean tilled row crops will be effective on larger and more thinly infested areas, but badly infested patches should be uncropped and the weed eradicated by more intensive measures.

HORTICULTURE.

[**Horticultural activities at the New Hampshire Experiment Station**] (*New Hampshire Sta. Bul. 203 (1922), pp. 13, 14, 24-26, 27, fig. 1*).—A progress report (*E. S. R., 46, p. 335*) for the year ended June 30, 1921.

In continuing studies in fruit bud formation in the Baldwin apple (*E. S. R., 33, p. 44*), begun by the station in 1908, the tillage cover plus fertilizer

plats again showed the greatest growth increase, as indicated by measurements of trunk diameter and annual twig development. In 1920 the fertilized plats in this experiment outyielded the unfertilized by approximately 50 per cent, and, furthermore, it is believed that the fertilized trees are more regular in bearing. Computations of the probable error in average yield and growth per tree for the different treatments showed considerable variation in respect to yield in three small plats, one in sod and the others tilled in alternate years.

Further work in the shading project (E. S. R., 46, p. 138) showed that the moisture and total nitrogen content are higher in the growth of shaded than unshaded trees, with free reducing sugars and starch lower.

Studies of the chemical changes in the wood of girdled trees showed an increase in free reducing sugars and sucrose and a decrease in total nitrogen and moisture as compared with untreated trees. Girdling also stimulated fruit bud formation.

Measurements of the growth in peach trees receiving various fertilizer treatments indicated nitrogen to be the chief factor in promoting vegetative development.

That manure plus fertilizer is more effective than manure alone in promoting yield of vegetables was indicated in the maintenance of fertility in garden soils project, the data for which are presented in detailed tabular form. The plat receiving plant food at the rate of 16 tons of manure, 160 lbs. nitrate of soda, 250 lbs. tankage, 800 lbs. acid phosphate, and 300 lbs. muriate of potash per acre not only outyielded in cabbage the 32 tons of manure plat but also returned a slightly higher net profit per unit of area. The application of lime to one-half of each plat had no material effect on yield.

Suckering experiments with two varieties of sweet corn, Early Crosby and Golden Bantam, indicated that this operation has no significant effect on yield.

[Report of the department of] horticulture (*New Mexico Sta. Rpt. 1921*, pp. 29-33).—In this brief record of activities during the year, data are presented for one project only, a cabbage fertilization study, in which, of the various fertilizer combinations tested, manure plus steamed bone gave the most satisfactory results.

[Horticultural work at the Pennsylvania Station, 1921] (*Pennsylvania Sta. Bul. 170 (1922)*, pp. 19, 26-29).—Activities under the various projects are briefly reviewed without the presentation of data.

In a study of the inheritance of form and color in phlox, salver-shaped flowers were found to be dominant over funnel-shaped blooms. Self-pollination of the hybrids gave plants, 75 per cent of which bore salver and 25 per cent funnel-shaped blooms. Cream color proved to be recessive to white.

Tests of cabbage stocks obtained by the selection of desirable parent plants from ordinary commercial lots indicated that many of these selections were superior to the usual commercial material, both in respect to uniformity of type and in yield. The satisfactory yield of 20 station selections of late cabbage in 1920 leads to the conclusion that selection is probably fully as important as soil and climate in cabbage production.

Tomato breeding activities discussed in this report were noted in an earlier paper (E. S. R., 46, p. 839). Selections from a mixed lot of rhubarb seedlings have yielded five strains which are deemed of promise on account of the abundant production of large, well-colored stalks.

In reviewing the results of long-continued fertilizer studies with the apple (E. S. R., 39, p. 445), it is concluded that trees in soils of normal fertility, operated on the tillage cover crop system of orchard management, rarely profit from the addition of fertilizers. Cultural studies with apples in Centre and

Franklin Counties have shown the value of organic matter in the soil and the need of nitrogenous fertilizers in sod orchards (E. S. R., 43, p. 538).

The application of 7.5 lbs. per tree of 4-8-6 fertilizer to peaches near North East has benefited the cover crop but shown no influence on the yield of fruit.

A new project is outlined in which apple trees grown from buds from a single tree worked on individuals of a single clonal rootstock variety are to be grown in cylinders filled with carefully prepared soil.

Propagating soils containing a large proportion of sand produced seedling cabbages which, on account of their abundant roots and restricted tops, were more easily transplanted than similar seedlings grown in richer soil. Field tests with fertilizers for early cabbage indicated that materials rich in phosphorus and nitrogen usually give a larger and earlier crop than that obtained by the use of any amount of manure. On the limestone soils at State College applications of 40 tons of manure per acre to early cabbage have not been profitable, probably due to the lack of phosphorus. Fertilizer tests with early cabbage and tomatoes in Cambria County indicated the importance of abundant nitrate of soda and acid phosphate.

[Report of the] department of horticulture, N. E. HANSEN (*South Dakota Sta. Rpt. 1921, pp. 29-37*).—A general report with reference to the behavior of fruits originated and distributed by the station and to breeding and selection studies now in progress.

Horticultural experiments, G. T. RATLIFF (*U. S. Dept. Agr., Dept. Circ. 209 (1922), pp. 34, 35, 36, fig. 1*).—Trials with numerous species and varieties of fruits at the San Antonio Experiment Farm are briefly reported.

None of the many varieties of peaches tested during 15 years proved fully satisfactory. Among the more promising kinds in respect to regular bearing, quality of fruit, and productivity were Arp, Honey, Annie Williams, Slappey, Tuskena, Carpenter, and Elberta. Of these varieties, Tuskena and Carpenter are clingstones, adapted for spicing. Among varieties of the plum, a fruit found to be particularly well adapted to this region, Gonzales, Terrell, Gold Coin, Shiro, and Santa Rosa have proved to be specially desirable. The jujube, or Chinese date, on trial since 1907, has produced satisfactory crops each year despite adverse climatic conditions. The Japanese persimmons, with the exception of two varieties, Costata and Okame, have shown a tendency to drop all their fruit before ripening. The apricot and the almond have proved unsatisfactory on account of bloom fall at the time of late spring frosts. The Rusk citrange is esteemed on account of vigorous growth and productivity. Four varieties of grapes, Sukfata, Champanel, Valhalla, and Xenia, produced fair yields in 1919.

[Horticultural investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 339 (1922), pp. 48, 49, 115, 116*).—Among various small fruits tested at the station by J. G. Moore, Perfection, Pomona, Wilder, and Red Cross currants and Downing and Pearl gooseberries have shown particular merit.

Striking contrasts were observed in a study by E. W. Lindstrom and E. D. Holden of sweet corn plants produced from selfed and cross-pollinated seed. The plants from the selfed seed were for the most part of low stature and poor yield and contained many defective types. On the other hand, the plants of mixed parentage were very uniform, vigorous, and in most instances were taller and produced larger yields than either parent. Certain combinations, such as Evergreen×Crosby and Evergreen×Hickox showed particular promise.

Rhubarb and sweet corn for the home garden, G. L. TREBOUT and R. W. AXT (*Louisiana Stas. Rpt. 1921, pp. 24, 25*).—Studies in rhubarb production indicated the necessity of annually importing roots from the North, since the

plants, ordinarily perennial, can not survive the unfavorable environmental conditions prevailing in Louisiana in late spring and early summer.

Satisfactory crops of sweet corn were produced despite the severe attacks of the corn earworm.

Fertilizer tests with tomatoes, 1921, F. B. RICHARDSON (*Mississippi Sta. Bul. 201* (1922), p. 15).—One-year fertilizer tests with the Globe tomato indicated the superior value of a complete formula, the nitrogen being derived from nitrate of soda. Barnyard manure applied at the rate of 16 tons per acre gave the second best results.

Orchard survey of the northeastern district of Colorado, E. P. SANDSTEN and C. M. TOMPKINS (*Colorado Sta. Bul. 272* (1922), pp. 3-28).—A compilation of statistical data pertaining to the fruit-growing industry in that section of Colorado comprising Larimer, Boulder, Jefferson, Adams, and Arapahoe Counties. Information is presented relative to distribution, size, and number of orchards, species and varieties grown, prevailing meteorological conditions, and future prospects. Apples, plums, and sour cherries are the principal fruits of this region. Ben Davis was found to be the most important apple variety from a numerical standpoint.

Orchard survey of the Arkansas Valley district, E. P. SANDSTEN and C. M. TOMPKINS (*Colorado Sta. Bul. 273* (1922), pp. 3-24).—In this paper, of the same general nature as the above, statistical and other data are given for the fruit industry in Fremont, Pueblo, Crowley, and Otero Counties. Ben Davis was again found to be the leading apple variety, with Jonathan and Delicious following.

Orchard survey of the southwestern district of Colorado, E. P. SANDSTEN and C. M. TOMPKINS (*Colorado Sta. Bul. 274* (1922), pp. 3-21).—Prepared in the same general manner as the above, this report deals with the fruit-growing industry in La Plata and Montezuma Counties. Practically the entire range of deciduous fruits were found growing successfully in the Montezuma district, but the development of the industry was found to be severely handicapped by inadequate transportation facilities. Jonathan was found to be by far the most numerous variety of apple.

Orchard survey of the western district of Colorado, E. P. SANDSTEN and C. M. TOMPKINS (*Colorado Sta. Bul. 275* (1922), pp. 3-45).—Of the same general nature as the above, this paper contains information relative to the fruit industry in that section of Colorado embracing Delta, Montrose, and Garfield Counties.

Cultivation and care of trees on the farm in Texas, H. NISS (*Texas Sta. Bul. 293* (1922), pp. 5-76, pls. 14, figs. 19).—This is a general treatise consisting for the most part of practical suggestions relative to the growing of different species and varieties of forest, shade, and fruit trees adapted to Texas conditions. Among the subjects discussed are orchard soils and their improvement; the effect of grasses and weeds on tree growth; wood lots for shelter; propagation of trees by seeds, grafts, and buds; planting; and pruning.

The Indian Cling peach, discussed in some detail in the text, is deemed of value as a peach stock on account of its extreme vigor, drought resistance, and longevity.

Comparative dusting and spraying of apples and pears, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul. 115* (1922), pp. 7-20, figs. 4).—In the same general manner as that of earlier reports (E. S. R., 44, p. 144), data are presented relative to investigations conducted in several Michigan orchards in 1920 and 1921.

A comparison of three materials, dilute lime sulphur plus arsenate of lead, sulphur dust, and dehydrated copper sulphate, for the control of scab and codling moth on 12-year-old Grimes Golden trees at South Haven in 1920 showed that the copper-lime dust was ineffective under the conditions obtaining in the experiment. The lime-sulphur solution and the sulphur dust were found of practically equal value for both pests. The foliage of the dusted trees was generally brighter and cleaner than that of the sprayed trees. Lime sulphur plus arsenate of lead spray and sulphur dust were compared in a 6-year-old Jonathan and Wealthy orchard at Fennville in 1921. Records taken on the Wealthy variety indicated that both materials were apparently of equal value in controlling scab, but that dust did not control codling moth as satisfactorily as did spray. Dusting investigations conducted in a mixed variety orchard at Traverse City showed fairly satisfactory control of scab and codling moth in all varieties except Delicious. In summing up the work of the two years with apples, the authors state that although sulphur dust has given satisfactory control of apple scab, somewhat inconsistent results were obtained with codling moth, depending upon the season of infestation.

A comparison of lime-sulphur solution, sulphur dust, and copper-lime dust in two Bartlett pear orchards at South Haven in 1920 indicated that liquid lime sulphur and sulphur dust are about equally effective for controlling scab on pears. The copper-lime dust did not give satisfactory results in either orchard. As in the apple orchard, the foliage of the pear trees dusted with sulphur mixture was uniformly more healthy than that of the liquid sprayed trees. Dust v. spray investigations carried on in 1921 in a mixed variety pear orchard at Fennville did not yield positive results, in that satisfactory control was obtained with both materials, due probably to the fact that the entire orchard had received a delayed dormant lime-sulphur spray. This early spray is believed by the authors to be of great value in the control of scab. Dusts and sprays are considered of practically equal value in controlling later infestations.

Controlling the curculio, brown rot, and scab in the peach belt of Georgia. O. I. SNAPP, W. F. TURNER, and J. W. ROBERTS (*U. S. Dept. Agr., Dept. Circ. 216 (1922), pp. 30, figs. 17*).—Following a general discussion relative to the efficacy of the protective measures in operation in 1921 in Georgia peach orchards, the authors report on the results of spraying and dusting investigations conducted in 1921 near Fort Valley, Ga., by this Department in cooperation with the Georgia State Board of Entomology.

Orchard sanitation, in the form of destroying rubbish, weeds, and brush adjacent to the peach orchards and in the gathering of immature drops, is deemed very effective in controlling the curculio. Records showed that over 13,000 curculio larvae emerged from 2.5 bu. of drop peaches gathered near Fort Valley. Disking the soil beneath the trees and collecting beetles by jarring trees also aided in reducing the number of insects.

Records taken over a period of 22 days on the number of curculios on a block of trees, treated four weeks after harvest with 90 per cent of hydrated lime and 10 per cent of arsenate of lead, showed a decrease of 13 per cent, while those on untreated trees increased 70 per cent in the same period, thus emphasizing the value of this late application.

Studies carried on in two orchards, one of Hiley and the other Elberta, indicated the importance of thorough and timely treatment, whether dust or spray. Curculio, the only pest of importance in the Hiley orchard, was best controlled by a spray program in which the trees received three applications of lead arsenate during the early stages of the fruit development. The plat thus treated had 13.23 per cent of wormy fruit, as compared with 54.14 for the check trees and 26.19 for the most effective dust. The value of a late application

of arsenate of lead was evident in that trees receiving this material about four weeks before the ripening of the fruit produced a notably lower percentage of wormy penches. Dusts containing 5 per cent of lead arsenate controlled the curculio practically as well as did those containing 10 per cent.

In the Elberta orchard all protective schedules were submitted to severe test on account of the prevalence of brown rot, scab, and curculio. This was evidenced by the fact that only 3.98 per cent of sound fruits were found in the harvested material from the check plat. As in the Hiley orchard, early and late applications of lead arsenate materially reduced the number of curculio infested fruits. Triplumbic arsenate did not control curculio as efficiently as did standard arsenate of lead. The lowest percentage of brown rot, 12.78, occurred on a plat receiving two applications of self-boiled lime sulphur. Scab was effectively controlled on the self-boiled lime sulphur plats.

Based on the results of the investigation, the authors present general recommendations, definite dust and spray schedules, and detailed directions for the preparation of various spray materials.

[**Cranberry and blueberry investigations in Massachusetts in 1919 and 1920**], H. J. FRANKLIN (*Massachusetts Sta. Bul.* 206 (1921), pp. 157, 164, 165, 168).—For the purpose of obtaining accurate data on the keeping quality of Pride, a most productive but not widely grown cranberry, fruit of this and of two other varieties, Early Black and Howes, was shipped in late October, 1919, in barrel lots to Washington, D. C., and there placed in cold storage (40 to 50° F.). Examinations of samples taken from several different locations within the barrels showed 41 per cent of sound berries from the substation's Early Black, while Pride from three commercial growers showed 69, 56, and 71 per cent, and two lots of Howes 79 and 83 per cent. Of the above lots the first two were sorted on November 15 and the others on November 22, 1919.

In continuing his reports (E. S. R., 43, p. 146) upon the resanding of cranberry bogs, the author presents tabulated data relative to a study conducted in the fall of 1920 upon the comparative keeping quality of Early Black cranberries grown on plats not sanded since 1909 and upon contiguous plats which had been sanded four times since that date. The slight differences recorded are believed by the author to be of no significance. The yields in bushels per square rod for the sanded and for the untreated areas given for the individual years 1916 to 1920 show a notable increase in favor of the sanded areas. The untreated plats are described as being much more sparsely vined than the sanded areas.

In addition to 68 plants of Pioneer blueberry received from the U. S. Department of Agriculture in 1919 and 1920, 82 buds of Pioneer and 208 of Cabot were inserted in the season of 1920.

Yields of varieties of pecans for 1921 (*Georgia Sta. Rpt.* 1921, pp. 18, 19).—Tabulated data are presented relative to the yield of pecan varieties at the station for the 1921 season and for the period 1914-1921, which includes the entire production of the trees since coming into bearing.

Spray and practice outline, C. P. HALLIGAN, R. H. PETTIT, and G. H. COONS (*Michigan Sta. Spec. Bul.* 114 (1922), pp. 3-28, figs. 9).—Although essentially a spray calendar for the principal fruit and vegetable plants grown in Michigan, additional information is contained relative to protective measures against various pests like peach yellows, peach borers, crown gall, etc., which are not controlled by spraying. Instructions are given for the preparation of various spray mixtures and for the use of the more common insecticides. A table of dilutions for concentrated lime sulphur is appended.

Insecticides and fungicides, 1920 and 1921, J. M. BARTLETT (*Maine Sta. Off. Insp.* 102 (1921), pp. 94-100).—A tabulation of insecticides and fungicides analyzed in 1920 and 1921.

FORESTRY.

Forestry [studies at the Pennsylvania Experiment Station] (*Pennsylvania Sta. Bul. 170* (1922), pp. 25, 26).—Observations upon the growth of trees in contiguous plantations of black locust and hardy catalpa set in 1908 on an upland site on the college farm showed a remarkable development in those rows of catalpa lying nearest the black locust. While black locust had succeeded on the site, the catalpa, with the exception of these few rows, had failed to make a satisfactory growth. Measurements, given in tabular form, of the diameter and average height of trees in the first nine rows of catalpa show a gradual decline in both diameter and height as the distance from the locust plantation increases. The presence of many locust seedlings within the first 40 ft. of the catalpa plantation leads to the assumption that the locust, a legume, has favorably influenced the growth of the catalpa by adding nitrogen to the soil.

This theory is supported by the results of analyses of soil collected beneath the locust and the large and small catalpa trees, the percentages of nitrogen in water-free soil being, respectively, 0.102, 0.098, and 0.089.

Prairie inclusions in the deciduous forest climax, H. C. HANSON (*Amer. Jour. Bot.*, 9 (1922), No. 6, pp. 330-337, figs. 2).—Careful observations and studies upon the factors leading to the existence of small prairie inclusions in deciduous forests in southeastern Nebraska led the author to conclude that the factor chiefly responsible for the maintenance of these prairie areas from invasion by the surrounding forest is the xerophytic environment produced in midsummer as a result of the great evaporating power of the air caused by exposure to intense sunlight and prevailing southerly winds. The soil water content in the open grass-covered areas was found to often fall below the point of availability, thus causing the death of young seedling trees.

Soil acidity preferences of some eastern conifers, E. T. WHERRY (*Jour. Forestry*, 20 (1922), No. 5, pp. 488-496).—This is a summary of studies upon the soil acidity preferences of 23 species and varieties of eastern United States conifers. *Pinus palustris*, *P. rigida*, *P. pungens*, *P. banksiana*, *Picea rubra*, *P. mariana*, *Abies fraseri*, and *Chamaecyparis thyoides*, although found in intermediate situations, all had a distinct preference for acid habitats. Of the 12 trees, *Pinus taeda*, *P. serotina*, *P. echinata*, *P. resinosa*, *A. balsamea*, *Tsuga caroliniana*, *P. virginiana*, *P. strobus*, *Taxodium distichum*, *Juniperus communis depressa*, *Tsuga canadensis*, and *Taxus canadensis*, showing a preference for intermediate habitats, the first 6 were also found in acid and the last 6 in circumneutral environments. Only 3, *Larix laricina*, *Thuja occidentalis*, and *J. virginiana*, showed a distinct calciphilous nature. Although the majority of the species studied showed an acid preference, the author does not believe that the presence of numerous conifers on a given area should be used as a positive index to the acidity of the soil.

Timber, H. TITUS (*Boston: Small, Maynard & Co., 1922, pp. 379*).—Prepared in the form of fiction, this book constitutes an urgent plea for the intelligent reforestation of the white-pine lands of the Great Lakes region.

Slash pine, W. R. MATTOON (*U. S. Dept. Agr., Farmers' Bul. 1256* (1922), pp. 41, figs. 21).—Following a general account relating to the botany, natural range, soil preferences, and usual methods of exploitation for turpentine, gum, fuel, and timber, the author presents information relative to the rate of growth in stands of different densities and to improved methods of handling plantations so as to obtain a maximum production of gum and timber.

Slash pine is deemed of great value for vast areas of the South which, on account of the poor drainage and low fertility, can not be profitably utilized

for agriculture. Well-stocked stands of slash pine on poor soils are capable of producing usable timber in 30 years at the rate of 100 to 250 board feet per acre per year and on better types of soils at the rate of 300 to 500 board feet.

Sitka spruce: Its uses, growth, and management, N. L. CARY (*U. S. Dept. Agr. Bul. 1060 (1922)*, pp. 38, pls. 21, fig. 1).—This is a general account relating to the Sitka spruce (*Picea sitchensis*), a species distributed in a narrow belt along the Pacific coast from Alaska to northern California and occurring for the most part in mixed stands with Douglas fir, western hemlock, and western red cedar. On account of the large size, erect trunk, and adaptability of the wood for many exacting uses, including airplane construction, this tree constitutes an excellent source of timber.

Information is presented in this paper relative to the range of the species; existing stands and rate of cut; uses of the wood; logging and milling operations; tree characters; associated species; climatic, soil, and light requirements; reproduction; fungus and insect enemies; etc. In addition to data on rate of growth, suggestions are included relative to silvicultural management of the species. Miscellaneous volume, height, and strength tables are appended.

The identification of true mahogany, certain so-called mahoganies, and some common substitutes, A. KOEHLER (*U. S. Dept. Agr. Bul. 1050 (1922)*, pp. 18, pls. 7).—Directing attention to the fact that over 60 species of timber have been marketed at various times as mahogany and the consequent need of accurate information for the identification of species, the author presents a key based on color, odor, and anatomical characters of the wood designed to assist in the determination of true mahogany and certain similar species. In addition, the various species are discussed in relation to taxonomy, distribution, physical properties, and structure of the woods. Photographic illustrations of magnifications of the end grain of the various species are appended.

The Maule reaction as a means of distinguishing between the wood of angiosperms and gymnosperms, P. D. SHARMA (*Jour. Forestry*, 20 (1922), No. 5, pp. 476-478).—Positive results were obtained in a test of the efficacy of the Maule chemical reaction as a means of distinguishing between hardwoods and coniferous woods. A total of 27 gymnosperms and 41 angiosperms were examined without discovering a single departure from expected results. In every case a distinct red color resulted with the angiosperms and indefinite yellowish and brownish colors with the gymnosperms. The Maule reaction is described as the successive application of potassium permanganate solution, dilute hydrochloric acid, and finally ammonia.

Poisonous woods, G. A. GARRATT (*Jour. Forestry*, 20 (1922), No. 5, pp. 479-487).—A compilation of information relative to the toxic properties of several tropical woods, including cocobolo, boxwood, satinwood, teak, etc. In no case was toxicity observed from the handling of the finished products, but was caused by the inhalation of, or external contact with, the dusts which arose in various processes of manufacture.

The forest flora of New South Wales, J. H. MAIDEN (*Sydney: Govt.*, vol. 7 (1920-1921), pts. 4-10, pp. 122-458, pls. 81).—In these 7 parts of the seventh volume of a continuing series (E. S. R., 43, p. 543) relating to the native trees of New South Wales data are presented relative to geographical distribution, character of trees, leaves, flowers, and fruit for about 40 species.

In addition, the following general information is appended to the various sections: Part 4, eucalypts as a source of honey; parts 5 and 6, insects injurious to timber trees; part 7, a chronologically arranged bibliography on eucalyptus oils; part 8, introduction of eucalypts into foreign countries; part 9, brief records of miscellaneous investigations concerning the strength of Australian timbers; and part 10, various enemies of forest trees.

Reports on forest administration for the years 1919 and 1920, E. CUBITT and B. H. F. BARNARD (*Fed. Malay States, Forest Admin. Rpts. 1919, pp. 42; 1920, pp. 36*).—These are the routine reports for the two years ended December 31, 1919, and December 31, 1920, and contain the usual information (E. S. R., 43, p. 542) relative to the constitution of the forests, administration, protective measures, and general silvicultural operations.

DISEASES OF PLANTS.

Plant diseases (*Georgia Sta. Rpt. 1921, pp. 11-14*).—Brief notes are given of plant disease investigations carried on at the station during the year covered by the report. In the search for tomatoes resistant to wilt some selections have been secured which are said to be giving very encouraging results. A study of *Sclerotium rolfsii*, which attacks pepper and sweet potato plants, was made, and characteristics of the mycelium were found by which the fungus can be definitely identified. In an investigation of the fruit rot of peppers some of the more important details of the overwintering and dispersal of the fungus and infection of the host have been determined.

In experiments for control of tobacco root rot, due to *Thielavia basicola*, formalin solutions of various strengths were applied to the soil, but the results indicate that the treatment to be effective would be too expensive for field use.

Brief notes are given on tests of strains of various potatoes which are resistant to mosaic.

During the season a number of additional species were found susceptible to peach rosette. Data are given regarding the resistance of plants to nematodes, a considerable list of species and varieties being enumerated. The resistant peach stocks which were under observation have continued to retain their resistance after two years in infested soils.

[Plant disease investigations in New Mexico] (*New Mexico Sta. Rpt. 1921, pp. 16-22*).—Progress reports are given of a study of apple measles, which is said to be the same as that previously described (E. S. R., 29, p. 649); a non-parasitic disease of the grape, which resembles a similar disease described from New York (E. S. R., 39, p. 552); occurrence of powdery mildew of the apple; and chlorosis of orchard trees.

Botany and plant pathology (*Pennsylvania Sta. Bul. 170 (1922), pp. 15-19, 19-20*).—The possibility of detecting by germination tests ears of corn infected with corn root and ear rots has been demonstrated, but it is claimed the increased production resulting from selection was not sufficient to warrant the recommendation of germinator tests for general farm practice.

In a previous publication (E. S. R., 40, p. 848) studies of potato wart due to *Chrysophyctis endobiotica* were reported. Additional investigations have shown that no infection takes place at soil temperatures of 22° C. (71.6° F.) or above, indicating a low temperature requirement for the fungus. Soil sterilization with steam or chemicals has not been found commercially practicable. Planting immune varieties of potatoes is considered the most feasible method of control. Several varieties of tomatoes have also been found subject to the attack of the fungus.

Studies of wilt of potatoes have shown that three species, *Fusarium oxysporum*, *F. cumarii*, and *Verticillium* sp., are involved in the wilt problem, and that most of the infection comes from the soil. Roguing was found practicable in keeping down the leaf roll of potatoes if practiced early in the season. Planting seed tubers for 2 years from stock infected to the extent of 2 to 5 per cent resulted in an increase of leaf roll to from 60 to 100 per cent. Roguing is considered impracticable in fields showing over 10 per cent of leaf roll.

A winter blight of tomatoes has been described (E. S. R., 38, p. 50). Continued studies have shown the disease is seed borne, and that high humidity and unbalanced nutrition of the host plant favor its incidence. Spraying tomatoes with Bordeaux mixture for the control of *Septoria* leaf spot resulted in a larger total yield of fruit but not in a greater proportion of ripe fruit due, in the authors' opinion, to the shading effect of the fungicide. Brief notes are given of three bacterial diseases of tomatoes, one caused by an organism closely resembling *Aplanobacter michiganense* and the others due to *Bacterium criticosum* and *Bacillus solanacearum*.

Experiments were begun in 1915 in cooperation with the department of horticulture for the control of clubroot of cabbage. The soil was treated with Bordeaux mixture, ammoniacal copper carbonate, formaldehyde, sulphur, and lump lime. The residual effects of Bordeaux mixture and lime were apparent after 4 years, but the soil was again thoroughly infested after 6 years. The treatments were repeated in 1921 with copper-sulphate solution, Bordeaux mixture, lump lime, milk of lime, ground limestone, lime sulphur, and nicotin sulphate. One year's planting since the second treatment showed that Bordeaux mixture applied in amounts equal to the heaviest treatment of calcium oxid gave the best results. Lime sulphur was injurious.

As a result of studies of truck crop diseases caused by *Sclerotinia*, a disease due to *S. minor* has been described (E. S. R., 45, p. 246). Continued observations of *S. libertiana* show that the fungus will die in the soil in 2 years if no susceptible crop is grown. Sterilization of soil in seed beds with formaldehyde solutions has proved effective and profitable.

A crown rot of rhubarb caused by *Phytophthora cactorum* has been found in Pennsylvania. Spraying with Bordeaux mixture prevented the spread of the disease.

In 1918, spraying with lime sulphur gave better control of apple rust than Bordeaux mixture or Pyrox. In 1919, Bordeaux mixture and Pyrox gave excellent control, much better than lime sulphur or Sulfocide. Sulphur dust was ineffective for the control of apple rust in 1920. Additional data on the control of black rot of apples since the results of previous work were published (E. S. R., 44, p. 53) show that liquid sprays readily controlled black rot if applied thoroughly and timely. Dust applications were effective only in seasons of light infection. All inoculation experiments to produce the disease have failed. Apple blotch was greatly reduced by spraying with lime sulphur, but applications of copper dust gave poor control.

As a result of special plant disease survey work, take-all of wheat was not found to be present in the State. The area infested with potato wart was mapped, and white pine blister rust and tobacco wildfire were reported as occurring in the State in 1921.

Plantings of strains of tobacco made in 1920 and 1921 in soil infested with *Thielavia basicola* have shown marked resistance to root rot on the part of some of the strains, the more resistant ones yielding double the crop of the more susceptible ones. In connection with tobacco work studies were made of the sterility of tobacco hybrids, and it was found that the embryos begin development but cease to grow after 5 to 7 days, resulting in seed with imperfect embryos. In some cases the endosperm fails to develop and empty seed are the result.

[Plant disease investigations] (Wisconsin Sta. Bul. 339 (1922), pp. 32-38, 39-48, 113, figs. 6).—Summary accounts are given of investigations conducted on various plant diseases.

Studies by J. G. Dickson on the influence of temperature on the development of the wheat scab organism shows that the fungus attacks wheat and corn

seedlings only under conditions unfavorable for their growth. Wheat blights at comparatively warm temperatures above 52° F. and corn at soil temperatures below 68°. On this account spring wheat should be sown as early as possible, winter wheat as late in the fall as can be done with safety, and corn planted after the soil has become warm and all cold periods passed.

It has been found that there is a distinct correlation between the percentage of wheat scab and the number of anthers remaining within the glumes of wheat flowers. Selections of wheat varieties have been made on this basis that have shown very great resistance to attacks of the wheat scab organism.

Spraying experiments by G. W. Keitt for the control of apple scab showed that Bordeaux mixture (4-4-50) caused some russetting of the fruit, while lime sulphur (1-40) and dry lime sulphur (4-50) gave a better finished product than Bordeaux mixture. Dust applications were not quite so efficient as sprays in the control of the disease. Three applications of Bordeaux mixture (3-3-50) gave excellent control of cherry leaf spot. The value of one spraying after gathering the fruit is pointed out. Dust applications did not prove as satisfactory as sprays. Experiments by L. K. Jones have shown that on black raspberry plants which had received the same treatment for two seasons a delayed dormant spray of lime sulphur in combination with gelatin or glue or Bordeaux mixture with gelatin controlled anthracnose commercially. A summer spray applied about a week prior to blossoming is considered essential to good control.

Experiments by W. B. Tisdale in breeding early cabbage for resistance to yellows have been begun and strains obtained that show a high degree of resistance. Studies by J. Monteith, jr., of the soil temperature and moisture relations of cabbage clubroot showed a wide range of temperature in which the fungus could develop, but when the moisture content of the soil was reduced to one-half its water-holding capacity there was no development in most soils.

The pea anthracnose, due to *Colletotrichum pisi*, made its appearance in Wisconsin in 1920, and was found by L. R. Jones and R. E. Vaughan to cause greater destruction to the crop than that produced by any of the well-known parasites.

An investigation made by L. R. Jones and J. C. Walker of the relation of soil temperature to the development of onion smut showed rapid development of the disease at 60°, and when the temperature rose to 84° it was completely checked. It was also found that the period of infection of the onion plant was confined to a few days after germination.

Investigations of tobacco diseases by J. Johnson have been continued, special attention being given to the temperature relationships of mosaic and wildfire diseases. The temperature response is believed to indicate that mosaic is due to an undiscovered organism. Continued studies of root rot of tobacco have shown that temperature exerts a great influence on the severity of the disease, warm weather materially reducing the damage. A strain of White Burley tobacco with upright leaves that is resistant to root rot has been developed.

The possibility of obtaining strains of barley resistant to the stripe disease caused by *Helminthosporium graminum* is indicated in experiments by A. G. Johnson and E. D. Holden.

Rust resistance in winter wheat varieties, L. E. MELCHERS and J. H. PARKER (*U. S. Dept. Agr. Bul. 1046 (1922), pp. 32, pls. 11, figs. 2*).—An account is given of work carried on cooperatively between the Kansas Experiment Station and the U. S. Department of Agriculture that resulted in the development of the wheat varieties Kanred, P1066, and P1068, which are resistant to stem rust. The behavior of the rust parasite on inoculated plants of the three resistant varieties seems to differ from that in other varieties described as resistant. In most of the other varieties prominent flecks appear in from 8

to 12 days after inoculation, and frequently small uredinia are produced. In the three varieties described, however, flecks are rarely visible and in no case have uredinia been observed.

Reports from a number of States indicate that these three varieties are resistant to stem rust, although in some localities they have been rather severely attacked. Very slight infection of leaf rust has been reported from 12 States in which they have been tested.

A *Phoma* root rot of celery, C. W. BENNETT (*Michigan Sta. Tech. Bul.* 53 (1921), pp. 5-40, figs. 21).—A description of the disease of celery caused by the fungus *Phoma apiicola* is described. In addition to celery, the fungus attacks parsley, parsnip, carrot, and caraway. The disease is said to attack the crown of the plants, causing the death of the leaves, stunting the plants, and pinching them off near the surface of the soil. The disease is also said to reach its maximum of destructiveness in the spring and fall, the hot weather of midsummer checking the advance of the fungus. Overwintering is known to take place in the trash in the field. Control measures recommended are the use of disease-free plants, destruction of trash which harbors the fungus, and the rotation of crops where the disease is prevalent and severe.

Relation of the character of the endosperm to the susceptibility of dent corn to root rotting, J. F. TROST (*U. S. Dept. Agr. Bul.* 1062 (1922), pp. 7, pls. 2).—A study was made of the physical characters of the ear or kernel to determine whether they were endosperm characters that were correlated with disease susceptibility. Ears were classified into starchy and horny endosperm, and plantings made are said to show that ears of seed corn of dent varieties characterized by starchiness of endosperm were infected with root rot organisms more frequently than seed ears characterized by horny endosperm in the same seed lots. Starchy ears of dent varieties produce larger numbers of weaker growing plants; more susceptible to root rots in the field, than do ears more horny in composition.

A new *Ascochyta* disease of cotton, J. A. ELLIOTT (*Arkansas Sta. Bul.* 178 (1922), pp. 3-18, figs. 13).—An account is given of a disease of cotton which appeared in west central Arkansas in 1920. The disease spread rapidly from the original centers of infection and in a short time killed many plants in the infected fields. All above-ground parts of the cotton plant were attacked except the flowers, and the fungus was found to cause a severe boll rot. Diseased material was collected in 1915, but apparently no further notice was taken of it. In both seasons the outbreak was preceded by a period of unusual rainfall and humidity. The author isolated a fungus from infected material and was able to produce the disease by inoculation experiments. The life history of the fungus and its characters, which apparently agree with descriptions of *A. gossypii*, have been determined, and it was found to live over winter in dead cotton stalks in the field and infect cotton plants the following spring. On this account rotation of crops is suggested as the most obvious remedy.

Experiments for the control of cotton root rot, G. T. RATLIFF (*U. S. Dept. Agr., Dept. Circ.* 209 (1922), pp. 32, 33).—In connection with the work at the San Antonio Experiment Farm, investigations were carried on for determining the value of fertilizers for the control of root rot in cotton. Results showed no effect in preventing the disease under the prevailing conditions. Other experiments are reported in which mulches, depth of distribution, and aeration of soil were studied, and from the results obtained, covering three seasons, it is concluded that root rot is in the soil and is very little, if at all, affected by aeration. Any beneficial effects of aeration were found to be of very short duration. Root rot was determined as occurring to a depth of at least 4 ft. Mulching had no effect on the control of the disease.

Work in potato diseases (*New Hampshire Sta. Bul.* 203 (1922), pp. 19-21).—The results of spraying experiments conducted by O. R. Butler are reported, in which it is shown that the protection afforded by Bordeaux mixture was reduced one-half when the pressure of application was reduced from 180 lbs. per square inch to 90 lbs. per square inch. In another series of experiments in which potatoes were sprayed with 2 nozzles to the row and with 3 nozzles to the row a decided advantage was shown by the use of the larger number of nozzles. In spraying experiments made to determine the comparative value of Bordeaux mixture and Burgundy mixture the results were markedly in favor of the use of Bordeaux mixture, and the greatest protection was afforded by the stronger solution (8-4-50). The effect on seed potatoes, after cutting, of dusting with sulphur, tricalcic phosphate, and gypsum was investigated, and the results show that gypsum is the best of the three substances experimented with, but none of them was at all effective in protecting the seed piece from decay.

Potato diseases, A. T. EVANS, G. JANSSEN, and M. FOWLES (*South Dakota Sta. Bul.* 196 (1922), pp. 396-410, figs. 4).—Descriptions are given of a number of the more common potato diseases occurring in South Dakota, with suggestions for their control. Among the diseases causing the greatest amount of damage are potato scab (*Actinomyces scabicus*), black scurf or Rhizoctonia (*Corticium vagum*), early blight (*Alternaria solani*), Hlburn, wilt (*Fusarium oxysporum*), jelly end rot (*F. radicola*), and blackleg (*Bacillus phytophthorus*). In addition to these diseases several others of common occurrence are described. For prevention, the authors recommend seed treatment with formaldehyde or corrosive sublimate solution, and for the disease of the above-ground parts of the plant spraying with Bordeaux mixture.

Fusarium tuber rot of potatoes, G. K. K. LINK and F. C. MEIER (*U. S. Dept. Agr., Dept. Circ.* 214 (1922), pp. 8, pls. 2).—A description is given of tuber rot of potatoes due to *Fusarium*, and suggestions are given for the control of the disease in the field and in storage.

Late blight tuber rot of the potato, G. K. K. LINK and F. C. MEIER (*U. S. Dept. Agr., Dept. Circ.* 220 (1922), pp. 5, pls. 2).—A description is given of the late blight of the potato due to *Phytophthora infestans*, and suggestions are given for the control of the disease in the field and in storage.

Recent investigations on the control of three important field diseases of sweet potatoes, R. F. POOLE (*New Jersey Stat. Bul.* 365 (1922), pp. 5-39, figs. 10).—The results are given of studies on the control of yellows or stem rot of sweet potatoes due to *Fusarium batatas* and *F. hyperoxysporum*, ground rot or "pox" (*Cystospora batatas*), and scurf or soil stain (*Monilochaetes infuscanus*). For the control of stem rot the author recommends the careful selection and treatment of the seed and hotbed management, and where the disease is severe, the planting of varieties which are known to be resistant to attack. For the prevention of ground rot or "pox," sulphur broadcasted at the rate of 200 and 400 lbs. per acre decreased the percentage of infection, but where it was applied in the hill and in the row it injured the roots. As a result of the investigations it is suggested that 300 to 400 lbs. of inoculated sulphur should be broadcasted per acre on infected soil about one month before planting the crop. For the control of scurf or soil stain, sulphur, inoculated sulphur, and Bac-sul reduced the disease to a minimum. The fungus is also destroyed by treating the seed with a solution of corrosive sublimate. Potatoes attacked by this fungus should not be used for seed.

Strains of Stand-up White Burley tobacco resistant to root rot, W. D. VALLEAU and E. J. KINNEY (*Kentucky Sta. Circ.* 28 (1922), pp. 3-16, figs. 6).—An account is given of breeding experiments with tobacco to secure strains

resistant to the root rot due to *Thielavia basicola*, and the authors describe strains of White Burley tobacco that are recommended for planting either on new land or old land that is known to be diseased.

Tomato mosaic, M. W. GARDNER and J. B. KENDRICK (*Indiana Sta. Bul.* 261 (1922), pp. 24, figs. 13).—The authors summarize the known facts regarding tomato mosaic, and suggest methods of control based largely on weed relationship to the spread of the disease. A number of annual and perennial solanaceous plants have been found that are subject to mosaic. Of these the perennial species are considered of most importance on account of the wintering over of the roots or rootstocks. Several species of ground cherry (*Physalis* spp.) and the horse nettle (*Solanum carolinense*) are common weeds in tomato fields in Indiana, and their eradication, together with any related species, is recommended. Suggestions are also made for seed bed and greenhouse control of this disease.

Phoma rot of tomatoes, G. K. K. LINK and F. C. MEIER (*U. S. Dept. Agr., Dept. Circ.* 219 (1922), pp. 5, pl. 1).—The authors describe the rot of tomatoes due to *P. destructiva*, and indicate the distribution of the disease, its development, and means for control.

Tomato spraying experiments (*New Hampshire Sta. Bul.* 203 (1922), p. 26).—A summary account is given of tomato spraying experiments carried on by J. H. Hepler in which plants grown under glass were sprayed with various strengths of Bordeaux mixture, ammoniacal copper carbonate, and formalin. The spraying did not benefit the plants as there was no disease, and in the case of 4–250 Bordeaux and 1–750 formalin the yields were materially reduced.

Dry lime sulphurs and similar materials for controlling apple scab and peach leaf curl, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul.* 115 (1922), pp. 51–54).—In a previous publication (*E. S. R.*, 44, p. 144) the results are given of several years' comparative tests of dry lime sulphurs and similar materials with lime-sulphur solution for the control of apple scab and peach leaf curl. In the present publication an account is given of experiments carried on subsequently. In 1921 a test of dry lime sulphurs with lime-sulphur solution as summer sprays for control of apple scab was conducted, and the results indicate that dry lime sulphurs did not give as good control of scab as the solution. Similar tests were made in 1920 for control of peach leaf curl, but the conclusion is reached that the control obtained with dusts was not satisfactory. No conclusive results were obtained from dusting experiments with grapes carried on during the seasons of 1920 and 1921.

Orchard practice for the control of blister canker of apple trees, H. W. ANDERSON (*Illinois Sta. Circ.* 258 (1922), pp. 16, figs. 12).—Descriptions are given of the blister blight of apple trees due to *Nummularia discreta*, and control measures are recommended that are based on known facts regarding the behavior of the parasite.

Pre-pink spraying of apples, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul.* 115 (1922), pp. 3–7, figs. 2).—Studies made in 1920 and 1921 are said to have indicated that scab infection occurs previous to the time the pink cluster application of fungicides is usually made. As spore discharge studies indicated that an earlier spraying should be adopted, applications of lime-sulphur solution (1½ parts to 50 of water) were used according to the regular schedule with additional application before the buds had separated in the clusters. The pre-pink application was made about two weeks before the buds were in the condition generally called the pink stage, and the results obtained showed that the earlier application is very desirable for the best control of apple scab, particularly in case of susceptible varieties.

Winter injury of apple roots (*New Hampshire Sta. Bul. 203 (1922)*, pp. 14-16).—A summary account is given of investigations carried on by G. F. Potter to determine what tissues are injured by cold, the environmental conditions during freezing and thawing as influencing the degree of injury, the conditions of growth and nutrition in producing hardy tissues, and the feasibility of developing a hardy strain of rootstocks which may be propagated vegetatively. About 2,000 seedling apple roots were frozen, and after freezing were planted in soil in the greenhouse and allowed to grow from 60 to 90 days.

Summarizing the results, it is noted that greater injury resulted where the roots were frozen rapidly, and roots in wet sand showed greater injury than those frozen in dry or medium wet sand. Roots that had been dried for 24 hours previous to freezing showed less injury from cold than normal turgid roots. As to the relative hardiness of scion roots from different varieties of trees, the roots of Dutchess and Hibernial were found most hardy, Dudley next, and Northwestern the least hardy of those tested. It was found that the amount of injury was not proportional to the diameter of the seedling. Roots divided lengthwise and examined showed strong correlation between the injury to the top section and the bottom section. The relative hardiness of individual roots is believed to be due to some internal difference.

Leaf spot control on cherries and plums, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul. 115 (1922)*, pp. 46-50, figs. 2).—Experiments carried on in 1920 and 1921 for the control of leaf spot of cherries and plums are reported, lime-sulphur solution, Bordeaux mixture, sulphur dust, and dehydrated copper sulphate dust being used. On the cherry trees, the results on the whole show that Bordeaux mixture ranked highest in leaf-spot control, but caused many of the leaves to fall. Lime sulphur ranked second, and the dust applications a little lower than the lime sulphur. With plums, lime sulphur, sulphur dust, and copper sulphate dust were used, and the results were not considered conclusive on account of the absence of, or very small amount of injury done by, the fungus.

The control of brown rot on peaches and plums, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul. 115 (1922)*, pp. 28-39, figs. 8).—A report is given of experiments carried on for the control of brown rot of peaches and plums in which lime-sulphur solution and sulphur dust were compared. The results of the experiments were considered satisfactory, and fruit from dusted trees held for several days after harvest showed much less rot than fruit from check trees. In 1921 the experiments consisted of the use of sulphur dusted on the trees, and while there was but little brown rot on certain varieties of peaches the development of rot subsequent to harvest was less on the fruit that had been treated.

Fungus disease [and other injuries of cranberry in Massachusetts], H. J. FRANKLIN (*Massachusetts Sta. Bul. 206 (1921)*, pp. 151-157, 165-168).—Flooding the bogs, after which the water was withdrawn, proved very effectual in controlling the rose bloom disease due to *Erobasisium oxycocci*. Wisconsin false blossom has been controlled in several bogs by the destruction of the infected vines. The probable origin of subsequent infestations is suggested.

The effect of submergence at relatively high temperatures on the small berries was tested, and considerable variation was found for different varieties. The injury to the fruit observed, due to submergence, was attributed to the rapid development of putrefactive fungi, a number of which are enumerated.

Spraying with lead arsenate and calcium arsenite for the control of fungus diseases again showed the reduction of some fungi on the fruit, but the effect on the vines was not considered desirable.

The relation of weather to cranberry flooding injury was investigated, flooding on dark, cloudy days being found very detrimental. This is considered due to the reduction of the oxygen content of the water to a state below the respiratory necessity of the plant. Dark swamp water or too deep flooding will operate in the same manner.

Another form of water injury to cranberry buds is described, in which chilling, following the draining of the water, resulted in the blackening of the buds and a great reduction in the setting of fruit.

Studies of certain fungi of economic importance in the decay of building timbers. W. H. SNELL (*U. S. Dept. Agr. Bul. 1053* (1922), pp. 47, pls. 8, figs. 3).—On account of the practical importance under mill conditions, studies have been made on the physiological relations of the basidiospores, mycelium, and secondary spores of *Lenzites sepiaria*, *L. trabea*, *Trametes serialis*, *Fomes roseus*, and *Lentinus lepideus*. All of these fungi have been found fruiting more or less commonly upon mill roofs or in basements. *Lenzites sepiaria* and *L. trabea* have been found to do more damage to coniferous roof timbers than has heretofore been reported. A description of the macroscopic and microscopic characters of the malt-agar cultures of the fungi, with a key to their identification, is given.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

[Report of the South Dakota Station entomologist], H. C. SEVERIN (*South Dakota Sta. Rpt. 1921*, pp. 24–28).—This report deals briefly with the three projects under investigation. The results of investigations of the web-spinning sawfly of plums and sand cherries (*Neurotoma inconspicua*) have been reported (*E. S. R.*, 44, p. 555; 46, p. 58).

Investigations of the life history of the common field cricket, *Gryllus assimilis* Fab., have been under way and are briefly reported upon. Its natural enemies discovered include two egg parasites (*Ceratoteleia marlatti* Ashm. and *Paradris* n. sp.), a tachinid parasite of the nymphs and adults (*Exoristoides johnsoni* Coq.), two mite parasites of the adults (*Euthrombidium* sp. and a gamasid sp.), and a threadworm parasitic within the nymphs and adults (*Paragordius varius*). Predacious enemies observed include the wasp *Chlorion cyanum* Dahlb. and several unidentified species of spiders. The egg parasites were the most important enemies, having destroyed as high as 50 per cent of the eggs.

The investigations of the wheat stem maggot (*Meromyza americana* Fitch) were continued, and a number of food plants were added to the list during the year. These include 11 varieties of wheat, barley, oats, rye, emmer, timothy, quack grass, slender wheat grass, western wheat grass, wild barley, brome grass, wild rye grass, green foxtail grass, and yellow foxtail grass. During the year the average injury done was found to be as follows: To wheat 1 to 15 per cent, to barley 2 to 4 per cent or more, to oats less than 1 per cent, and to spring rye 10 to 15 per cent. The parasites *Microbracon meromyza* Gah. and *Coelimidia meromyza* Forbes were reared from the larvæ. *Pediculoides ventricosus* was observed feeding upon the larva and a *Trombidium* sp. feeding upon the adult.

[Work with economic insects in Wisconsin] (*Wisconsin Sta. Bul. 339* (1922), pp. 38, 39, 49–62, figs. 7).—In experiments by L. K. Jones at Sturgeon Bay with dust treatments for codling moth control, using (1) sulphur-lead arsenate 90–10, (2) copper-lime-lead arsenate 10–80–10, and (3) sulphur-dry lime-sulphur-lead arsenate 75–15–10, it was found that seven applications of dust were less effective than five of lime sulphur and lead arsenate spray (lime sulphur 1–40 plus 1 lb. arsenate of lead).

The report deals further with the destruction of grasshoppers by use of poison bait, the importance of the cherry aphid and of the pea moth, beekeeping, the potato leafhopper, the use of nicotine dust, and tests of the distance to which cucumber beetles fly.

Insect pests of the home garden and their control, A. FRANK (*Western Washington Sta. Bino. Bul.*, 10 (1922), No. 1, pp. 3-7, figs. 4).—This is a brief account of some of the more important insects attacking vegetable crops with means for their control.

[Studies of cranberry] insects, H. J. FRANKLIN (*Massachusetts Sta. Bul.* 206 (1921), pp. 158-164).—The author reports that the green spanworm, *Cymatophora sulphurea* (Pack.), was unusually prevalent in 1920 and wiped out a fine crop promise on several bogs in Duxbury. Several females reared and dissected before oviposition contained from 103 to 117 eggs each.

The brown spanworm (*Epelis truncataria faxonii* Minot), which was found in great numbers on 12 different bogs in 1919, appeared abundantly on even more bogs in 1920. The use of lead arsenate powder, 3-50, proved very effective in combating it. It is pointed out that spraying should be done when the eggs begin to hatch, since the worms are poisoned most easily in their first stages, and are sometimes numerous enough to destroy a fine crop promise within four days after hatching begins. The small worms seem usually to attack the flower buds as soon as they feed, a hole commonly being eaten through the ovary.

The cranberry girdler (*Crambus hortuellus* Hübner) was much more abundant in 1920 than it had been for many years. Several hitherto unreported parasites of the girdler were reared, namely, *Cremastus facilis* (Cress.), by which about 10 per cent of the cocoons were parasitized; *Maciocentrus* sp., and *Phygadeuon* sp. Barn swallows were found to capture large numbers of the girdler moths. One part of Blackleaf 40 in 400 parts of water with 2 lbs. of soap to 50 gal. added readily killed the girdler moths.

Observations of the cranberry root grub (*Amphicoma vulpina* Hentz.) indicate that the larval stage lasts three or four years.

On July 20 the army worm was the source of damage to a bog at Assonet which had been bared of its winter flowage June 16, and was abundant on a bog in Carver bared of its flowage July 2. It is thought that this pest probably never greatly harms cranberry bogs reasonably free of grasses except in infestations following very late removal of the winter flood.

Egg parasitism of the cranberry fruitworm ranged in 1919 from 16 to 88 per cent on dry bogs and from 0 to 37 per cent on flowed ones, and in 1920 from 14 to 50 per cent on dry bogs and from 0 to 25 per cent on flowed ones.

Spraying tests with the blackhead fireworm in 1920 support previous experience in indicating that while 1 part of Blackleaf 40 in 800 parts of water, with 2 lbs. of soap to 50 gal. added, is fairly effective in killing the worms, it is probably better economy, all things considered, to use the insecticide at the rate of 1 part to 400 parts of water. One part to 800 with the soap kills the moths satisfactorily. At either strength the spray is safe to use when the vines are in bloom.

The gipsy moth, which in 1919 was the source of more injury to bogs than any other insect, did little harm in 1920. Tests made with the spray gun or open nozzle in combating it showed this nozzle to be unsatisfactory for bog spraying. It is pointed out that experience in experiments in recent years have shown that the gipsy moth can be readily controlled in bogs by (1) holding the winter flowage until May 25, (2) reflooding about May 29 for 36 hours, (3) spraying with lead arsenate (3 lbs. of powder or 6 lbs. of paste to 50 gal. of water) about May 24, and (4) keeping the maturing worms from getting

onto the bogs. The latter is done by removing the trees, especially the oaks, for some distance back from the bog margin, and by keeping the marginal ditch cleaned out and partly full of water and maintaining a film of kerosene or crude oil on the water during the worm-crawl period.

"Experience and the results of recent experiments lead to the conclusion that winter-flowed bogs not reflowed in June should be sprayed once regularly, a few days before the vines blossom, with this mixture: Blackleaf 40 1 gal., water 400 gal., and fish-oil soap 16 lbs. This treatment largely takes the place of the June reflow in reducing various harmful pests, especially the blackhead fireworm, the spittle insect (*Clastoptera vittata* Ball), the girdler, and leaf-hoppers (mainly species of *Euscelis*) and the springtails (*Collembola*). These forms abound among the vines of bogs not reflowed and must drain their vitality considerably. Cranberry vines often seem stimulated in growth by nicotine sprays. Probably this is usually due to the reduction of insect drains."

Insects infesting stored food products, R. N. CHAPMAN (*Minnesota Sta. Bul.* 198 (1921), pp. 5-76, figs. 28).—This is a summary of information which has been prepared with a view to aiding in determining the insects causing injury, their source, and means for combating them. An illustrated table for determining the species of insects is included.

The control of household insects, W. P. FLINT (*Illinois Sta. Circ.* 257 (1922), pp. 24, figs. 15).—This is a summary of information.

Some pests of Ohio sheep, D. C. MORE (*Ohio Sta. Bul.* 356 (1922), pp. 51-79, figs. 19).—This is a summary of information upon the more important insect and acarine parasites of sheep in Ohio.

The onion thrips in Iowa, J. L. HORSEFALL and F. A. FENTON (*Iowa Sta. Bul.* 205 (1922), pp. 68, figs. 11).—In this account it is pointed out that there are four principal sources of infestation in the spring, namely, set or multiplier onions; greenhouses where tomatoes or cucurbits are grown; piles of refuse such as tops, culls, and screenings which are left in the field over winter; and wild perennial host plants. These sources of infestation can be very largely eliminated and thrips epidemics thus greatly reduced.

"Results of three seasons' spraying tests with nicotine sulphate and soap for the control of the onion thrips have demonstrated that under Iowa conditions this is not effective in seasons when these insects are abundant enough to cause damage. This is largely because this insecticide does not kill the eggs within the leaf nor the pupae in the soil at the base of the plants and also because many larvae escape by being in the axils of the leaves. Furthermore, many winged adults escape and later reinfest the sprayed plants. Where comparatively few plants are infested early in the season, the thrips breeding on them can be controlled to advantage by spraying with nicotine sulphate and soap to prevent later infestation of larger areas. Control is effective at this time because the plants are small and practically all the insects can be hit by the spray."

Dusting v. spraying for red bugs, J. D. LUCKETT (*New York State Sta. Bul.* 490, pop. ed. (1921), pp. 8, pl. 1, fig. 1).—This is a popular edition of the bulletin previously noted (*E. S. R.*, 47, p. 157).

A promising new treatment for the San José scale, A. L. QUAINANCE (*U. S. Dept. Agr. Clip Sheet* 193 (1922), p. 1).—In the Bentonville, Ark., section, where the San José scale is now exceedingly abundant and destructive, orchardists have been unable to adequately control the pest with the usual dormant tree treatments with lime-sulphur spray. This has led the Bureau of Entomology to conduct experiments with the lubricating-oil emulsion spray, found by Yothers to control the citrus scale and the orange white fly in Florida (*E. S. R.*, 39, p. 160).

The experiments, which were conducted by A. J. Ackerman under the authors' direction, included tests of lubricating oils of strengths from 0.5 to 4 or 5 per cent, thoroughly emulsified with potash fish-oil soap. One thorough application of a spray of a strength as low as 2 per cent of oil resulted in a practically complete killing of the scale. The results obtained have been so satisfactory that orchardists will make extensive use of the 2 per cent oil spray in bringing the pest under subjection. The experience in Florida in spraying citrus trees in foliage with 1 per cent of oil leads to the conclusion that dormant deciduous trees will probably stand without injury one annual treatment with 2 per cent of oil. It is pointed out, however, that several seasons' experience will be necessary before a final decision as to possible injury to the trees, twigs, or fruit buds can be reached.

The stock emulsion consists of "Red Engine oil or oil of similar grade 1 gal., water $\frac{1}{2}$ gal., and potash fish-oil soap 1 lb. The oil, water, and soap are placed in a kettle or other receptacle and heated until the contents come to a boil. A brown scum appears on the surface of the mixture as it first begins to boil. After boiling for a few minutes the brown scum begins to disappear, and at this stage the kettle is removed from the fire and the entire mixture is pumped twice under pressure of about 60 lbs. while still very hot. A proper emulsion can not be made by stirring, nor should the mixture be allowed to cool before it is pumped. Too much pumping will often break up the emulsion. During pumping, ordinary pump packing is burnt up rather quickly by the hot oil mixture. For making the stock emulsion on a large scale an all-metal pump would be necessary. The stock emulsion contains $66\frac{2}{3}$ per cent of oil. To make a 2 per cent emulsion for use in a 200-gal. spray tank it is necessary to use 6 gal. of the stock emulsion. Precaution should be taken to prevent the stock emulsion from freezing, which occurs at a temperature of about 15° F. above zero. . . .

"Any one of the following or similar oils may be used, some one or more of which can doubtless be obtained in most parts of the country: Diamond Paraffin oil, 180 Red Neutral, Jr. Red Engine oil, and Nabob oil. An oil which has given excellent results in the experiments herewith reported has approximately the following characteristics: Specific gravity (20° C.) 0.914, flash point 173° C., fire point 204° C., viscosity (20° C.) (Engler, $H_2O=100$) 17.31, volatility (loss at 105° C.—4 hours) 3.3 per cent, acid or corroding substances none, distillation 300–370° C. 48 per cent, and above 370° C. 52 per cent by volume."

Some observations on the control of pear psylla, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul. 115 (1922), pp. 21–28, figs. 3*).—The indications that the treatment generally recommended in Michigan for control of the pear tree psylla, namely, the general cleaning up of the orchard, scraping the bark, and making a dormant application of nicotine sulphate or of a miscible oil in the late fall or early spring, will not give satisfactory results when the psyllas are numerous, as many of them do not hibernate on the pear trees but return to them in the spring and lay their eggs, have led to investigations of other methods of control. The fact that the eggs are all deposited on pear trees and may be destroyed by certain spray materials has led to experimental work which shows that lime-sulphur solution, 6.25–50, is effective for killing the psylla eggs. (Similar results have been obtained by Hodgkiss in New York (*E. S. R.*, 31, p. 651) and Ross and Robinson in Canada (*E. S. R.*, 45, p. 454).) Observations made throughout the season in the orchards of several successful growers, mostly in the Fennville district, are reported upon at some length.

In the orchards under observation the dormant application to kill the hibernating adults was not effective under conditions prevailing during the fall and spring of 1920–21. Two applications, one before blossoming to destroy the eggs

and one after blossoming to kill the nymphs, were very effective in some orchards, but in others the same or a greater number of applications were not effective. In one orchard a single application after the petals had dropped of a mixture containing lime sulphur, lead arsenate, hydrated lime, and nicotin sulphate gave satisfactory results. It is concluded that the thorough use of nicotin sulphate in any one of several combinations will be effective at any time during the summer when the psyllas are in the nymph stage, but that the summer sprays are not effective when used against the adults.

"Injury to the first leaves nearly always develops after the use of strong lime sulphur to destroy psylla eggs, but such injury is not serious nor permanent. Flower buds may be injured under some conditions, and some varieties seem more susceptible than others. Freezing temperatures following the application have a tendency to increase such injury. In order to avoid injury to the blossom buds it is advisable to make the application of strong lime sulphur not later than when the buds have begun to separate in the cluster, and as some varieties blossom earlier than others each one should be sprayed when it reaches the proper stage of development.

"The practice of spraying with strong lime sulphur just before the blossom buds have begun to separate in the cluster has several advantages aside from its value in destroying psylla eggs. San José scale should be effectively controlled at this time, pear leaf blister mite will be greatly reduced, and in districts where pear scab is prevalent it takes the place of the 'pre-pink' application for scab control. Thoroughness of application is a factor of greatest importance and can not be emphasized too strongly."

Apple aphids controlled with the delayed dormant spray, J. D. LUCKETT (*New York State Sta. Bul.* 487, pop. ed. (1921), pp. 8, figs. 2).—This is a popular edition of the bulletin previously noted (E. S. R., 46, p. 351).

Eastern strawberry louse, W. J. BAERG (*Arkansas Sta. Bul.* 179 (1922), pp. 3-16, figs. 4).—Through rearing the aphid here considered and the species occurring in California known as *Myzus fragaeifolii* Ckll. and making comparisons of the two in all their stages, the author has found them to represent different species, and the name *M. brevopilosus* n. sp. has been given to the one which occurs in the East. Studies of the seasonal and life history of this species by the author, made both at the Arkansas Station and at Ithaca, N. Y., are reported upon, partially in tabular form, and technical descriptions and illustrations of its stages are included.

The pest is a small greenish or yellow aphid that feeds on the under surface of the leaves of the strawberry. At the station the winged forms begin to appear about the middle of September, and by early October most of the maturing females are winged and apparently migrate somewhere. By a daily count of the cast skins from a certain number of the young the length of the different instars was determined as 2 days for the first, from 3 to 4 days each for the second and third, and from 3 to 5 days for the fourth. The period of growth or development therefore covers from 11 to 15 days.

M. fragaeifolii has been reported to be a source of injury to the strawberry in Arizona and California.

Experiments for the control of the peach tree borer with paradichlorobenzene, W. C. DUTTON and S. JOHNSTON (*Michigan Sta. Spec. Bul.* 115 (1922), pp. 40-45, figs. 4).—Experiments with paradichlorobenzene were conducted in several orchards during 1920 and 1921, the results of which are briefly reported, partly in tabular form. In all the experiments the borers which were in such position that they could be affected by the paradichlorobenzene were effectively controlled. On the trees with smooth trunks and few wounds most of the

borers were low enough to be effectively treated, but on older trees with rough bark and many wounds along the trunks and in the crotches a large proportion of the borers were too high to be subject to this treatment. The trees treated were all six years of age or older, and there was no evidence of injury in any of the experimental orchards. It is pointed out that the serious, unavoidable injury to the bark of trees caused by digging out the borers is avoided by this method of control.

The blackhead fireworm of cranberry on the Pacific coast, H. K. PLANK (*U. S. Dept. Agr. Bul. 1032 (1922), pp. 46, pls. 3, figs. 15*).—This is a report of cooperative investigations conducted by the Washington Station and the Bureau of Entomology during the years 1918 and 1919.

In an appended paper entitled Systematic Description of *Rhopobota naevana* Hübner (pp. 42–45), C. Heinrich reports that this pest, previously held to be a distinct American species described by Packard in 1869 as *racciniata*, is none other than the European species *naevana*. The American species *Epinotia ilicifoliata* Kearf. he finds to be a variety of *R. naevana*.

This fireworm is the most important cranberry pest of western bogs, and at the time it was first observed by the author it was causing an estimated loss of approximately 40 per cent of the combined crops of Washington and Oregon. As a result of a better knowledge of its life history and habits and more general adoption of better methods of control, this loss was reduced to approximately 15 per cent in 1918 and in 1919 to approximately 5 per cent.

The investigations indicate that this pest was introduced into the Northwest through eggs on cuttings from bogs in eastern States, principally from Massachusetts. It is now found on nearly every cranberry bog on the Pacific coast.

Studies of its life history and habits and control measures are presented at some length, together with descriptions of its several stages. It was found to pass through two generations and sometimes a partial third. The larvae of the first generation appear on the bogs in greatest abundance about the latter part of May, the pupae toward the middle of June, and the moths about the first or second week in July. Only about four-fifths of the eggs laid by this generation hatch to form a second generation the same season, the remaining one-fifth hatching the following spring. About one-third of the eggs of the moths of the second generation hatch late in the summer, forming a third generation of larvae.

In control experiments "40 per cent nicotin sulphate at the rate of 1 part to 800 parts of water, with the addition of fish-oil soap at the rate of 2 lbs. to every 50 gal., used at the rate of about 300 gal. to the acre, was found to be the most effective spray material against the fireworm. Forty per cent nicotin sulphate, used at the rate of 1 part to 1,000 parts of water with the addition of fish-oil soap, 2 lbs. to every 50 gal., was nearly as effective.

"Nicotin oleate made by mixing 2.5 parts of a solution containing 40 per cent free nicotin with 1.75 parts of commercial oleic acid, or red oil, and used at the rate of 1 part to 400 parts of water, applied three times at the rate of about 300 to 400 gal. per acre, was found nearly as effective as 40 per cent nicotin sulphate 1 to 800 with fish-oil soap 2 to 50, applied three times at the minimum rate per acre. Arsenate of lead proved of little or no value in the control of the fireworm. Fish-oil soap, 2 lbs. to 50 gal. of solution, was a much better spreader for spray solutions on cranberry foliage than glue, which was used at the rate of 1 lb. to 200 gal. One compound containing a high percentage of crude carbolic acid and usually employed as a disinfectant gave little or no control.

"Demonstration spraying experiments were conducted in which 40 per cent nicotin sulphate 1 to 800 with fish-oil soap 2 lbs. to 50 gal. was used. Four

applications on McFarlin vines, in which the eddy-chamber mist type of nozzle was used, gave the best results, producing the largest yield of berries and the highest percentage of berries free from fireworm injury. . . . Four applications with the spray gun on the Howe variety gave the highest percentage of unfested fruit of all the plats on which the spray gun was used. Generally speaking, four applications gave better results than three.

"On bogs that can be reflooded, a complete covering of the vines with water for not less than 48 hours during the middle or latter part of May is recommended as a help in the control of the fireworm. Since most of the bogs on the Pacific coast, however, are managed as dry bogs, spraying with 40 per cent nicotine sulphate 1 to 800, with the addition of fish-oil soap at the rate of 2 lbs. to every 50 gal., is recommended as the most feasible method of control of the blackhead fireworm in that locality. Between 250 and 300 gal. of this material should be used per acre."

Six years of life history studies on the codling moth, A. B. FITE (*New Mexico Sta. Bul.* 127 (1921), pp. 183, figs. 16).—This is a report of investigations commenced in the spring of 1914 and continued without interruption until the fall of 1919, at which time they were concluded. That part of the investigation relating to band records kept from 1907 to 1916 has been reported in Bulletin 110, previously noted (*E. S. R.*, 39, p. 765). The investigations are reported on year by year in large part in tabular form. Diagrams with curves showing the daily emergence of moths, deposition of the eggs, and hatching of the larvae for the years 1915 to 1919, respectively, and other showing the seasonal history of the codling moth for the same years are included.

There were found to be four generations at the station at an altitude of 3,820 ft., where the growing season is 193 days, the fourth generation not being completed until the following spring, when the spring brood of pupae and moths appear. The pupation of overwintering larvae began from February 18 to March 1 and ended from April 19 to May 24. The pupal stage of the spring brood varied in length from 20 to 26 days, with a mean average length of 23.36 days. The moths of the spring brood began to emerge from March 20 to 30, the last usually appearing about May 20. The first brood of moths usually began to emerge about June 12, following which emergence was continuous throughout the season. The division between the first and second broods usually comes about July 20, and the dividing point between the second and third broods usually comes about August 22.

"The spring brood of moths deposited an average of 3.12 eggs per moth. The average deposition by the first brood of moths was 10.4 eggs per moth; that of the second brood was 11.5 eggs per moth; and the third brood deposited an average of 10.7 eggs per moth. . . . Egg deposition began, on the average, about April 8 and ended approximately September 25. The last of the first brood were usually deposited about May 15 and the first of the second brood appeared about June 14, making an interval of about 29 days between the first and second broods. . . . Eggs of the first brood had an average incubation period of 10.9 days; those of the second brood averaged 5.14 days; third brood eggs incubated for an average of 5.46 days; and the fourth brood eggs hatched in an average of 6.37 days after deposition.

"First-brood larvae usually appeared from about April 26 to May 23. Second-brood larvae began to hatch about June 20, and hatching continued quite regularly to near the middle of September. A great variation was recorded in the feeding period of larvae. Some larvae seem to develop to full size and leave the apples in 10 days after entering them, while others did not leave the fruit for 60 to 70 days after entering it. The average feeding period of the first brood of larvae was 22.5 days, that of the second brood

was 18.67 days, the third brood fed for an average of 23.62 days, and the fourth brood required 25.64 days to complete their feeding. The records showed about 6 per cent of the first brood of larvae to be wintering larvae, 10 per cent of the second brood wintered over, 89 per cent of the third brood wintered, and all of the fourth were wintering larvae.

"The average lengths of the cocooning periods of the first, second, and third broods of larvae were 6.44, 4.36, and 6.12 days, respectively. The pupal stage of the first brood averaged 12.15 days in length, the second brood averaged 10.43 days, and the average of the third brood was 10.43 days.

"The average length of the life cycle of the first generation of the codling moth was 48.16 days, the average of the second generation was 36.71 days, while the third generation passed through all of the different stages from egg to adult in an average of 39 days."

Observations on the poisonous nature of the white-marked tussock moth (*Hemerocampa leucostigma* S. and A.), H. H. KNIGHT (*Jour. Parasitol.*, 8 (1922), No. 3, pp. 133-135).—The use of purslane (*Portulaca oleracea*) by mashing the leaves into a mucilaginous pulp and applying it to the swollen parts, gave surprising relief from the effect of poisoning from the tussock moth.

Webworms injurious to cereal and forage crops and their control, G. G. AINSLIE (*U. S. Dept. Agr., Farmers' Bul.* 1258 (1922), pp. 16, figs. 12).—This is a summary of information in which the author deals with the cornroot webworm (*Crambus caliginosellus* Clem.), striped webworm (*C. mutabilis* Clem.), blue-grass webworm (*C. teterrellus* Zinck.), vagabond crambus (black-headed sod webworm), leather-colored sod webworm (*C. trisectus* Wlk.), and the silver-striped webworm (*C. praejectellus* Zinck.).

A contribution to our knowledge of the Syrphidae of Colorado, C. R. JONES (*Colorado Sta. Bul.* 269 (1922), pp. 3-72, pls. 3, figs. 60).—This bulletin consists of three parts: (1) Description, life histories, and food habits (pp. 3-9), (2) key to genera and species of Colorado Syrphidae with citations and habitat (pp. 10-42), and (3) catalogue of known Colorado Syrphidae (pp. 45-58).

Horseflies and cattle, S. B. DOTEN (*Nevada Sta. Bul.* 102 (1921), pp. 13, figs. 8).—This is a popular summary of information intended for use by stockmen and farmers, which is based upon investigations in cooperation with the Bureau of Entomology, U. S. D. A., and to be reported in a bulletin in preparation. It is concluded that as regards the western green head horsefly (*Tabanus phaeonops*), which is the principal species, "At present the only hope of control lies in the drainage of wet grass-hay meadows, followed by the planting of alfalfa."

Herpetomonas muscae-domesticae, its behavior and effect in laboratory animals, R. W. GLASER (*Jour. Parasitol.*, 8 (1922), No. 3, pp. 99-108, pl. 1).— "House flies in proximity to cattle were found engorged with cow blood. A close association between the feeding habits of *Stomoxys*, *Haematobia*, and *Musca domestica* was observed. House flies often feed at the punctures deserted by the biting flies. *H. muscae-domesticae* [Bur.] was found to be the most prevalent flagellate inhabiting the digestive tract of adult house flies in summer. The number of flies parasitized was large. The greatest degree of parasitism was reached in July and August. The parasitized flies were always caught in cow barns and in horse stables. Flies caught in dwelling houses were not parasitized."

Experimental leishmaniasis or herpetomoniasis were not produced with *H. muscae-domesticae*. A special method for the cultivation of this parasite is described.

Control of root maggots (*New Hampshire Sta. Bul.* 203 (1922), pp. 11-13).—Control work with the cabbage maggot by W. C. O'Kane has shown the marked efficiency of a mixture composed of equal parts of finely ground tobacco dust and agricultural lime. In one series eggs placed in contact with soil in the normal manner gave a 100 per cent hatch, whereas eggs placed in contact with the mixture gave a percentage of hatch ranging from 0 to 31 per cent. In a second series, the percentage of hatch in the treated lots was 14 and in the check lots 82, and in a third series the hatch in the treated lots was 5 and in the check lots 71 per cent.

Counts of larvae and pupae on the roots of plants which had received the mixture indicated a failure of larvae to reach the roots on treated plants for a period of several days following the treatment, but later an increasing number of larvae appeared on the roots. The addition of moisture to simulate rain after newly deposited eggs had been placed in contact with the mixture resulted in a hatch of 16 per cent, as compared with a hatch of 93 per cent where the eggs were placed in contact with the soil and water added. Where, however, eggs were placed on soil and wet down with an infusion made by permitting the mixture to stand in water, the percentage of eggs that hatched was nearly as great as that of check plats.

Experiments carried on to determine whether maggots on the roots of plants are killed by infusions of the mixture carried down through the soil gave inconclusive results, there being a mortality of from 4 to 10 per cent as compared with 0 per cent in the checks. The number of flies emerging in the case of treated pupae varied from 0 to 6 per cent, as compared with 10 per cent in the case of the checks. Experiments indicated that oviposition on treated plants was much less than on the checks, but that heavy rains rapidly reduced such repellent action. A further treatment four days after the rain again appeared to give protection.

Control experiments with a view to determining the possible utility of a poison bait consisting of banana pulp and sodium arsenite gave inconclusive results.

The bionomics and control of the onion maggot, J. R. EYER (*Pennsylvania Sta. Bul.* 171 (1922), pp. 16, figs. 5).—The first part of this account (pp. 3-9) deals briefly with the history, anatomy, and biology of the onion maggot, the second part (pp. 9-16) with its seasonal history, ecology, and the results of control work.

A poison bait consisting of sodium arsenite $\frac{1}{4}$ oz., molasses 1 pt., water 1 gal., and chopped onion $\frac{1}{4}$ lb. was found to be the most practical and efficient remedy for its control on extensive areas. In such fields an average increase of 90 bu. of onions per acre was produced when this material was applied. The use of shallow cans for distributing bait throughout the plats gave a uniformly better control than the sprinkling method. These cans should be placed preferably 10 or 15 ft. apart in every tenth row. The cost of labor and materials for placing and refilling the tins with bait once each week from April until August was \$10.50 for each acre treated. The protection of an acre of onions requires 24 cans when placed 15 ft. apart in every tenth row throughout the patch, and 1 gal. of the liquid will fill these cans to a depth of about 2 in. at each application. A less amount in a container will necessitate repeating the operation more often than once each week, which under ordinary conditions was found to be sufficient.

A carbolic acid emulsion consisting of crude carbolic acid $\frac{1}{4}$ pt., soap $\frac{1}{4}$ lb., and water 1 gal. was quite effective in controlling maggots on small onion plats when applied as a spray. "Frequent treatments with this material entail a large amount of time and labor and cause this method to be impractical for

commercial purposes. Strengths exceeding 2 per cent carbolic acid injure the onion plants and can not be used with safety. The results from sowing carbolated lime and calcium hypochlorid with onion seed are promising, and these materials merit further investigation." The importance of rotation and clean culture, particularly the collection and disposal of onion refuse in the autumn, is pointed out.

Fluke infections and the destruction of the intermediate host, F. C. BAKER (*Jour. Parasitol.*, 8 (1922), No. 3, pp. 145-147).—The author concludes that the control of such snails as are intermediate hosts of certain species of flukes inimical to man and the domestic animals, as suggested by Chandler (*E. S. R.*, 44, p. 581), while applicable to small bodies of water not connected directly with running streams or large lakes, is absolutely impracticable for running streams and larger bodies of water. "To successfully eradicate all possible intermediate hosts of flukes would necessitate the pollution of water bodies to such an extent that most forms of life would be ultimately killed; in comparison with this toxic agent, when used effectively, our present stream pollution by sewage would sink into insignificance."

FOODS—HUMAN NUTRITION.

Methods of manufacturing potato chips, M. C. VOSBURY (*U. S. Dept. Agr. Bul.* 1055 (1922), pp. 20, figs. 10).—This publication reports the results of a special study of methods of making potato chips and determinations of the value of different varieties for making chips by the standard method adopted. Among the suggestions applicable both to home and commercial manufacture of potato chips are the following:

Vegetable oils or compounds are more satisfactory than animal fats and liquids preferable to solid fats. High grade cottonseed oil heated to approximately 210° C. (410° F.) is considered the best medium in which to fry chips. The best vessel in which to fry the chips is an iron or steel vessel, deep rather than wide, and with an inner perforated basket in which the chips can be lowered and raised. Mature potatoes high in starch give the best results, provided the slices are thoroughly washed in cold water and a maximum of the starch removed.

In the experimental tests in which potato chips were scored on a basis of 30 points (ease of cooking 10, appearance 5, crispness 5, and flavor 10), Green Mountain potatoes gave the best score, 26.6.

Observations on canning and preserving of figs, W. V. CRUESS (*Fig and Olive Jour.*, 6 (1921), Nos. 3, pp. 2, 3; 4, pp. 5, 8).—This is a general description of methods of preserving figs, based upon the literature on the subject and upon results of small-scale experiments conducted at the California Experiment Station.

The relation between the energy value of foods as determined by calculation and by combustion, J. KÖNIG and J. SCHNEIDERWIRTH (*Ztschr. Untersuch. Nahr. u. Genussmittel*, 12 (1921), No. 1-2, pp. 3-23).—This paper contains, in addition to a comparison of the energy values of typical foods as determined by combustion and by calculation from the percentage composition previously noted (*E. S. R.*, 46, p. 755), a report of an investigation of the utilization of different foods as related to their energy value determined in the two ways. The junior author served as the subject in two series of metabolism studies, one lasting six and the other five days. The diets of the two periods differed only in the amount of crude fiber or so-called indigestible carbohydrates, white bread and pea soup of the first period being replaced by black

bread (pumpernickel) and pea soup prepared by cooking the pods with the peas. The fat in the first diet was butter and in the second oleomargarin. The food and feces were analyzed and the energy value determined by combustion and calculation.

The energy value of the first diet was 3,248.2 calories as determined by combustion and 3,219.3 by calculation, and of the second 3,574.9 and 3,474.6 calories, respectively. The corresponding coefficients of digestibility were 93.84 and 94.44 for the first and 84.49 and 85.53 for the second period, respectively. These results are considered to furnish sufficient evidence in support of the conclusions drawn in the first part of the investigation, as previously reported, that it is sufficiently accurate to determine the energy value of a diet by calculation.

The utilization of food with reference to the energy value as determined by calculation and by combustion, as well as to the intestinal juices mixed with the feces, J. KÖNIG and J. SCHNEIDERWIRTH (*Chem. Ztg.*, 45 (1921), No. 154, pp. 1245, 1246).—Noted above from another source.

A study of weight regulation in the adult human body during over-nutrition, A. GULICK (*Amer. Jour. Physiol.*, 60 (1922), No. 2, pp. 371-395, figs. 2).—This is the report of an extensive study of weight regulation on diets of different caloric value in the case of a subject representing the "spare" or apparently nonfattening type. The investigation, which comprised over 370 days on the experimental diets, included studies of (1) the minimum food requirement for maintenance of weight at the customary level, (2) the extent to which an excess of starchy food can be stored by this type of person in a long period of superabundant diet, and (3) possible changes in the minimum requirement of food after the body has returned to the initial weight with the least possible loss of nitrogen.

The subject was found to have an extravagant caloric requirement, which was noticeable on the low caloric diet and which increased during the course of an excessive carbohydrate diet and remained above the initial level even after return to normal weight. The basal metabolic rate was no higher than the average for the subject's weight, height, and age, and the pulse and blood pressure were both normal. It is suggested that the high caloric output and consequent resistance against fattening may find its explanation either in a condition of nitrogen enrichment, or in an upward variation of the "cost of digestion" (and assimilation) of starchy food.

Studies in nutrition.—IX, The nutritive value of the proteins from the Chinese and Georgia velvet beans, A. J. FINKS and C. O. JOHNS (*Amer. Jour. Physiol.*, 57 (1921), No. 1, pp. 61-67, figs. 4).—Continuing the series of studies previously noted (*E. S. R.*, 46, p. 564), the authors report that the isolated proteins obtained by heat coagulation from either Chinese or Georgia velvet beans are adequate for the normal growth of white rats. The protein of the Chinese velvet bean prepared by dialysis resulted in lack of growth even after cystin was added. The bean meal, when fed cooked or autoclaved and supplemented by either cystin or casein, resulted in nutritional failure, regurgitation, diarrhea, and ultimately death. The authors are of the opinion that an associated toxic substance, probably the dihydroxyphenylalanin of Miller (*E. S. R.*, 44, p. 710), is responsible for the nutritional disturbances observed in the case of the steam-cooked meal.

The influence of meat upon physical efficiency, S. H. BASSETT, E. HOLT, and F. O. SANTOS (*Amer. Jour. Physiol.*, 60 (1922), No. 3, pp. 574-577).—In an effort to throw some light on the influence of meat upon physical efficiency, the capacity for work on a high and low protein diet was tested in four subjects as follows:

For one week the usual normal diet was taken by each subject, and the second week this was supplemented by a luncheon containing 300 gm. of beef, served with bread, butter, and boiled potatoes. This period was followed by a third period of the same length during which little or no meat was taken, and in the fourth and final week the diet of the second period was taken. During the entire time data were obtained on the average number of steps per day (by means of a pedometer), and on the pulse rate before and after a definite period of exercise (swift walking) in the morning and afternoon. The urine was analyzed daily for nitrogen.

The tabulated data show that the presence or absence of meat from the dietary in periods as long as one week had no demonstrable effect on the capacity for doing the work prescribed. It was also noted that there was a distinct and uniformly present sense of sleepiness for two or three hours following the ingestion of a large amount of meat, and that removal of the meat from the dietary did not diminish the sense of well-being in the various subjects. "The well-nigh universal opinion that meat ingestion is important for the maintenance of physical strength is not to be disregarded, but the experimental evidence in favor of this conception has yet to be produced."

The retention and distribution of amino acids with special reference to the urea formation, O. FOLIN and H. BERGLUND (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 395-418).—This paper reports a study of the transportation, retention, and excretion of nitrogenous constituents, such as amino acids, urea, and creatin, supplementing a similar investigation of carbohydrates previously noted (*E. S. R.*, 47, p. 263). The amino-acid determinations were made by the new colorimetric methods described on page 410.

The first point considered was the hypothesis that deamination and urea formation are localized in the liver. Although this hypothesis was considered definitely disproved by the work of Folin and Denis previously reported (*E. S. R.*, 28, p. 664), experimental results obtained soon after by Van Slyke were regarded by him as confirming the theory of the liver as being the special site of urea formation. To obtain further evidence on this point nitrogen determinations were made on the blood and urine of several subjects following an ordinary mixed meal and following the ingestion of a large amount of gelatin, glycine, or casein.

The data obtained show in all cases a predominant increase in the non protein nitrogen of the plasma, associated during the early stages of absorption chiefly with increases in the amino-acid nitrogen and in the later stages with increases in the urea nitrogen. The figures for urine follow the same lines. During the first 2-hour period in which the amino-acid accumulation in the blood was approaching the maximum the urea nitrogen excretion rose only very slightly, while at the end of 3 hours there was a decided rise in urea which continued for about 3 hours. "As far as we can see there is now nothing more that need be said concerning the old tradition that one special function of the liver is to split off amino nitrogen and convert it into urea."

The data obtained following the ingestion of large amounts of protein and amino acids also indicate that losses of ordinary usable amino acids are normal occurrences, and that these losses are increased during and immediately following increases in the amino-acid content of the blood. This is thought to indicate that there is no mechanism for the control of amino-acid retention, such as is the case with glucose. Whenever there is an influx of amino acids from the digestive tract sufficiently rapid to raise materially the amino-acid content of the blood, as happens after every fairly protein-rich meal, there is an increase in the excretion of the amino acids in the urine. The opposite, however, does not take place as the result of fasting.

A comparison of the figures obtained for plasma and corpuscles points not only to the permeability but to the actual production of urea in the corpuscles. The undetermined or rest nitrogen is also from two to five times as abundant in corpuscles as in plasma. The theory is advanced that the undetermined nitrogen of human blood is in large part due to the presence of histones similar to those obtained from the corpuscles of bird's blood.

An effect of the ingestion of colostrum upon the composition of the blood of newborn calves, P. E. HOWE (*Jour. Biol. Chem.*, 49 (1921), No. 1, pp. 115-118).—Protein analyses of the blood of newborn calves before and after feeding with colostrum and milk are reported which show that the blood of a newborn calf does not contain euglobulin until after it has received colostrum. If the calf suckles a cow that has been lactating for some time and is yielding milk known to contain little euglobulin, the amount of this protein in the blood remains negligible for several hours and increases much more slowly than in a calf which has received colostrum.

The function of the colostrum, J. H. LEWIS and H. G. WELLS (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 12, pp. 863-865).—The literature on the nature and function of colostrum is reviewed and discussed, various observations being cited which lead to the conclusion advanced by Fannu'ener (E. S. R., 27, p. 476) and by Wells and Osborne (E. S. R., 46, p. 9) "that the formation of colostrum is for the purpose of presenting to the newborn mammal a concentrated solution of serum globulin which carries antibodies from the maternal blood during the brief time that these protective proteins can be absorbed unaltered from the alimentary canal in an active condition."

The observations of Howe reported above are cited in confirmation of this hypothesis, and data are presented on similar observations conducted on the blood of adults and young infants. These data confirm for human beings the observations of Howe on calves that they are born with no euglobulin and acquire it at least in large part from the colostrum. One important function of the colostrum is considered to be to furnish to the newborn mammal protective antibodies which probably add to its capacity to resist infection in early life. If the infant is not breast fed and does not receive colostrum, it is thought to acquire euglobulin in its blood much more slowly and to be in a corresponding degree less resistant to infection.

Studies of infant feeding.—XVI, A bacteriologic study of the feces and the food of normal babies receiving breast milk, E. W. BROWN and A. W. BOSWORTH (*Amer. Jour. Diseases Children*, 23 (1922), No. 3, pp. 243-258).—In continuation of the studies previously noted (E. S. R., 46, p. 863), bacteriological studies of breast milk and the feces of infants fed breast milk are reported.

The data presented indicate that the stools of normal breast-fed babies show a complete dominance of *Bacillus bifidus*. Infants which have been fed on cow's milk formulas for several days and then given breast milk may show bacteriologically the effects of the cow's milk for as long as four weeks, as indicated by a larger number of cocci and Gram-negative bacilli than are usually found in breast-milk stools. If a cow's milk formula is used before the third day after birth and breast milk thereafter, the resulting fecal bacteria are those of a normal breast-fed infant.

B. bifidus was also isolated from a number of samples of breast milk. It is the author's belief "that the bifidus organisms which are present in or on the mother's nipple are an important source of the bifidus organisms found in the nursing's intestines."

Studies of infant feeding.—XVII, A bacteriochemical study of the acid stools excreted by breast-fed and bottle-fed infants, A. W. BOSWORTH, H. K.

WILDER, M. E. BLANCHARD, E. W. BROWN, and M. F. McCANN (*Amer. Jour. Diseases Children*, 23 (1922), No. 4, pp. 323-337, figs. 4).—In continuation of the above studies, an investigation was undertaken to determine the nature and cause of the acid stools often eliminated by either breast-fed or bottle-fed infants. Determinations were made of the water-soluble acidity and the total volatile acid content of 24-hour samples of feces, and the nature of the volatile acids was investigated by the method of Dyer (*E. S. R.*, 37, p. 13).

The results obtained with the stools of breast-fed infants showed conclusively the presence of formic acid in considerable amounts, together with some acetic acid, while the acid stools of bottle-fed infants contained acetic acid. A bacteriological examination of the stools showed the predominance of *Bacillus bifidus* in breast-milk stools and of Gram negative organisms, principally of the coli-aerogenes group including *B. aerogenes*, in the stools of bottle-fed infants. Pure cultures of *B. aerogenes* isolated from several stools were found to have the property of decomposing citric acid, with the formation of water, carbon dioxide, and acetic acid as has previously been observed with cultures of this organism from dairy products (*E. S. R.*, 24, p. 277). In addition to *B. aerogenes*, *Micrococcus ovalis* and other unidentified organisms obtained from acid stools were found to change citrates to acetic acid, while *B. bifidus* formed a mixture of acetic and formic acids, and *B. coli*, *B. capsulatus*, *B. acidilactici*, and *B. cloacae* formed carbon dioxide and water.

It was demonstrated further that when food containing no citrate is fed to an infant no acetic acid appears in the stools; that if a food containing a soluble citrate is fed a small amount of acetic acid appears in the stools; and if a food containing an insoluble citrate is fed a large amount of acetic acid appears in the stools. This is thought to explain the large amounts of acetic acid found in stools of infants receiving a commercial dry milk. The process of drying is considered to convert a considerable portion of the soluble citrate originally present in the milk into insoluble calcium citrate, which results in a marked increase in the acetic content of the stools.

Milk the best food, H. STEENBOCK and E. B. HAER (*Wisconsin Sta. Bul.* 342 (1922), pp. 19, figs. 10).—A popular discussion of the food value of milk, particularly from the standpoint of vitamins.

[**Vitamin studies at the Wisconsin Station**] (*Wisconsin Sta. Bul.* 339 (1922), pp. 123, 124, 130-132).—From a study of the content of vitamin C in various farm feeds, the amounts required daily to protect a guinea pig from scurvy are given as follows: One gm. of green forage from oats, alfalfa, corn or timothy, 15 of cabbage, 3 of rutabaga or turnip, 5 to 10 of potatoes, 10 of yellow carrots, and 20 to 30 gm. of sugar beets, sugar mangels, or table beets.

In studies by H. Steenbock, M. T. Sell, and E. Nelson, the relative richness of milk in vitamins A and B is shown by the fact that 2 cc. daily of whole milk has been found sufficient to produce normal growth in rats fed white corn, while 16 cc. daily was necessary to provide sufficient vitamin B for normal growth. Centrifugal skim milk is reported to furnish only one-tenth as much vitamin A as whole milk. Vitamin A has been shown to be destroyed to some extent by the direct rays of the sun, indicating that hay exposed too long in the swath may be lower in vitamin content than hay cured in the windrow or in cocks. Further evidence of a relationship between yellow pigmentation and vitamin A is furnished in the observation that in the yellow corn kernel the vitamin occurs chiefly in the highly pigmented endosperm, while the slightly pigmented germ contains little of the vitamin, although it has a high content of fat.

Fat-soluble vitamin.—X, Further observations on the occurrence of the fat-soluble vitamin with yellow plant pigments, H. STEENBOCK and M. T.

SELL (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 63-76, figs. 4).—Further data confirming the senior author's theory of association of vitamin A with yellow pigmentation are presented in continuation of the series previously noted (*E. S. R.*, 46, p. 469). White sweet potatoes and white carrots were found to contain but little vitamin A. The tops of white carrot roots pigmented with chlorophyll were richer in vitamin A than the bottoms of the same roots containing less pigment. White cabbage leaves in the head contained only one-tenth as much yellow pigment as green cabbage leaves and a much lower content of vitamin A.

Vitamin A in oranges, T. B. OSBORNE and L. B. MENDEL (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 187, 188).—The earlier conclusion, drawn from preliminary tests, that dried orange juice contains vitamin A (*E. S. R.*, 43, p. 765) has been confirmed. Rats were cured of ophthalmia within a few days by the daily administration of 10 cc. of fresh orange juice, or the same amount of juice mixed with starch and desiccated in a current of hot air. Five cc. also proved sufficient to cure ophthalmia, but a larger amount was necessary to secure restoration of growth. Volume for volume, orange juice is considered to be as rich as milk in vitamin B, somewhat less rich in vitamin A, and much richer in vitamin C.

Some plant sources of vitamins B and C, F. O. SANTOS (*Amer. Jour. Physiol.*, 59 (1922), No. 1, pp. 310-334, figs. 14).—This is the complete report of the investigation previously noted from the preliminary report (*E. S. R.*, 46, p. 667).

The vitamins in cod liver oil, H. LAX (*Biochem. Ztschr.*, 125 (1921), No. 5-6, pp. 265-271).—The author reports unsuccessful attempts to cure polyneuritic fowls with the alcohol extracts of cod liver oil, thus showing that it is lacking in vitamin B. The fact that high temperatures are used in refining cod liver oil for medicinal purposes is presented as evidence that the anti-rachitic factor is not identical with vitamin A, which in his opinion would undergo destruction in such temperatures. The excellent results obtained with the use of cod liver oil as a source of vitamin A are ignored.

A study of the metabolism and respiratory exchange in poultry during vitamin starvation and polyneuritis, R. J. ANDERSON and W. L. KULP (*New York State Sta. Tech. Bul.* 88 (1922), pp. 3-22; also in *Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 69-89).—An extensive study is reported on the basal metabolism of poultry (hens), and the metabolism during the digestion of grain and mash, digestion of rice, vitamin starvation, polyneuritis, and on recovery from polyneuritis. For determining the respiratory exchange a small respiration apparatus was used which was a duplicate of the one described by Murlin (*E. S. R.*, 32, p. 860). The observations on the normal basal metabolism were made from 18 to 20 hours after the hens had received a ration of grain and mash. The periods of observation were begun after the hens had been in the apparatus from 1 to 1½ hours, and lasted from 60 to 90 minutes. The observations during digestion were made from the second to the sixth hour after the food was given, and those during vitamin starvation from 18 to 20 hours after feeding polished rice.

As noted by other workers, the first apparent effect on the hens of vitamin starvation was a loss of appetite. This was followed by a continuous loss in weight with the appearance of active symptoms of polyneuritis in about six weeks. The average metabolism of the different experiments was as follows:

Basal metabolism 3 calories per kilogram per hour, digestion of grain and mash 3.55, digestion of rice 3.14, vitamin starvation 2.27, and polyneuritis 2.26. The respiratory quotients for the different periods were respectively, 0.79, 1.01, 1.07, 0.76, and 0.77.

The most striking effect of the vitamin starvation is considered to be the inability of the animals to utilize a normal quantity of food, and the consequent decided decline in heat production. On recovery from polyneuritis the heat production rose rapidly, but the appetite remained poor and the gain in weight was slow.

Data are also given on the protein, potassium, and phosphorus metabolism on the polished rice diet. The protein balance was decidedly positive and the balance for potassium and phosphorus only slightly negative. The fact that polyneuritis developed in practically the same length of time, irrespective of the quantity of rice consumed, is thought to argue against the presence of any specially toxic principle in polished rice.

The accessory food factors.—II, The significance of the content of water-soluble extracts, R. GRALKA and H. ARON (*Biochem. Ztschr.*, 126 (1921), No. 1-4, pp. 147-152, figs. 2).—Using the same basal ration as in their previous study (*E. S. R.*, 46, p. 256), the authors have tested the value of additions of autolyzed carrot extract, or this extract plus a small amount of bran. In all cases the growth and life of rats were prolonged by the addition of these extracts. It is concluded that both water-soluble and fat-soluble vitamins are excellent for the growth and well being of rats, and that the effect of the lack of either one is accentuated in the absence and lessened in the presence of the other vitamin.

The effect of cooking upon the antiscorbutic vitamin in cabbage, W. H. EDDY, E. SHELLOW, and R. A. PEASE (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 155-160, figs. 2).—This is the report of a study of the effect of pressure cooking upon the vitamin C content of cabbage. With the LaMer-Sherman scurvy-producing ration, described in the article previously noted (*E. S. R.*, 46, p. 865), 1 gm. of fresh cabbage daily proved completely protective against scurvy, while 5 and 10 gm. of cabbage cooked in an open kettle for from 45 to 90 minutes, and the same amount cooked in a pressure cooker at from 100 to 121° C., proved inadequate to protect against scurvy, as did also the same amount of cabbage acidified with vinegar and heated in the pressure cooker for the same length of time.

These results show that under the above conditions there is apparently no difference between the pressure cooker and the open kettle in the destruction of vitamin C, and also indicate that acid reaction and exclusion of oxygen do not prevent such destruction.

The distribution of inorganic phosphate of the blood between plasma and cells, T. F. ZUCKER and M. B. GUTMAN (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 169-171).—The authors report that when inorganic phosphate is to be determined in the blood it is immaterial whether the whole blood or only the plasma is used, provided the analysis is made immediately by the method of Bell and Doisy (*E. E. R.*, 44, p. 613). If considerable time elapses after the blood is drawn before the analysis is made, the whole blood is higher in inorganic phosphate than the plasma. The rôle of inorganic and organic acid soluble phosphates in the blood is considered to be as follows:

"The red cell is totally permeable to the phosphate ion, i. e., no 'osmotic influences' control the distribution of the phosphate ion inside and outside of the cell. Phosphate ions can be taken up by the cell and stored as organic acid-soluble phosphate. This organic phosphate is hydrolyzed very easily when there is need for phosphate ion in the plasma, similar to the liver glycogen yielding blood sugar. The diffusion of the phosphate out of the cell, however (at least in vitro), is slower than its rate of formation by hydrolysis."

Observations on the inorganic phosphate of blood in experimental rickets of rats, M. B. GUTMAN and V. K. FRANZ (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 171-174).—The conclusions of Howland and Kramer (*E. S. R.*, 46, p. 165) concerning the level of inorganic phosphate in the blood of human rickets as compared with normal subjects, has been confirmed with work on rats, the phosphates being determined by the method of Bell and Doisy on whole blood (*E. S. R.*, 44, p. 613).

In general, a reduction in the inorganic phosphate of the blood was found to run parallel to the degree of severity of the rachitic lesions. In normal diets the range of blood phosphate was from 5 to 8.2 mg. P per 100 cc., while on high phosphorus intake the range was from 6 to 9.8 mg. On diets containing 86 mg. per cent phosphorus, all of the rats developed rickets and the blood phosphate ranged from 2 to 5 mg. P per 100 cc. On the addition of as small an amount as 75 mg. of phosphorus per 100 cc. the rachitic lesions failed to appear, and the blood phosphorus averaged between 5.5 and 6 mg.

One group of rats on the low phosphorus diet was treated with light from the mercury vapor lamp as a preventive measure. Protection against rickets was secured, but the blood phosphorus did not rise above the upper range of rachitic blood. Similarly in curative experiments with cod liver oil on another group of rats on the same diet there was active calcification of the cartilage, while the blood phosphate was still in the rachitic range. It is concluded, therefore, that a definite deposition of calcium salts may occur before the blood phosphorus regains its normal level.

Pathogenesis and treatment of rachitis, I. JUNDERI (*Hygiene*, 83 (1921), No. 22, pp. 753-776; *abs. in Jour. Amer. Med. Assoc.*, 78 (1922), No. 10, p. 772).—The author considers rickets to be due to overnutrition with the consequent interference of the functioning of the cells. In harmony with this view, remarkable results are reported in the treatment of infantile rickets by relative inanition, either alone or supplemented with cod liver oil and phosphorus.

It is stated that with overfeeding treatment with cod liver oil does not prevent the development of rickets. A number of cases are reported showing the details and results of the treatment recommended. The total intake of calories is reduced to from 65 to 70 per kilogram of body weight per day from a normal of about 100 calories. Not more than from 60 to 75 cc. of milk is allowed per day per kilogram. To this are added sugar and flour to bring the calories to the proper amount, or potatoes or porridge for older children.

Some of the factors contributing to toxicity of botulinus toxin by mouth, J. BRONFENDBRENNER and M. J. SCHLESINGER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 20, pp. 1519-1521).—This is a general discussion based upon investigations previously noted from other sources (*E. S. R.*, 46, p. 669). The chief factor contributing to the toxicity of botulinus toxin by mouth is considered to be its resistance to the condition of H-ion concentration of the stomach during active digestion.

ANIMAL PRODUCTION.

[Animal nutrition work at the Wisconsin Station] (*Wisconsin Sta. Bul.* 339 (1922), pp. 120-123, 124-129, pgs. 5).—A number of experiments in animal nutrition are briefly summarized.

In continuing the work previously reported (*E. S. R.*, 45, p. 270) on the value of yellow and white corn for hog feeding, additional results by F. B. Morrison, J. M. Fargo, and G. Bohstedt have verified the first experiments. Morrison, R. S. Hulce, and G. C. Humphrey found white corn to give as good results as yellow for feeding calves which received whey and hay, but

yellow corn seems to be superior for poultry which do not receive plenty of green feeds. Experiments with laying pullets under the direction of J. G. Halpin and H. Steenbock further demonstrated the deficiency of white corn in the fat-soluble vitamin, since when cod liver oil or pork liver was added to the ration a much higher level of production was maintained.

E. B. Hart and H. Steenbock found that when rations of corn and oil meal plus 1 per cent of salt and 2 per cent of rock phosphate were fed to pigs they showed stiffness of the joints and difficulty in getting on their feet in from 6 to 8 months. Ten per cent finely ground paper added to this ration did not prevent the condition, whereas 10 per cent charcoal seemed to prevent it and 10 per cent dirt partially prevented it. Giving the sick animals daily doses of cod liver oil soon brought them around all right. The conclusion is drawn that roughage itself may not be necessary for swine if the ration supplies adequate nutrients and vitamins.

In continuing the work previously reported (E. S. R., 44, p. 64) on the importance of lime for stock by Hart and Steenbock, it was found that hay and stover growing on different soils varied greatly as to the amount of calcium they contained, depending on the soil where grown.

The influence of the plane of nutrition on the maintenance requirement of cattle, A. G. HOGAN, W. D. SALMON, and H. D. FOX (*Missouri Sta. Research Bul. 51* (1922), pp. 5-48, figs. 8) —This is a more detailed report of the work previously noted (E. S. R., 46, p. 168).

Range and cattle management during drought, J. T. JARDINE and C. L. FORSLING (*U. S. Dept. Agr. Bul. 1031* (1922), pp. 83, pls. 10, figs. 9).—This bulletin gives data collected on the Jornada Range Reserve in southern New Mexico, bringing the material already reported (E. S. R., 38, p. 470) up to 1920, with special reference to the period of drought from 1916 to 1918. The rainfall for the different years and for the growing seasons (July, August, and September) is recorded, with comparisons as to the amount of grass on areas protected from grazing, overgrazed, partially grazed during the growing season but fully grazed during the rest of the year, and areas fully grazed but not overgrazed. Two main types of grass were found to exist in different parts of this range, i. e., grama grass and tobosa grass. It was found that the grama grass range begins to die out the second year of a drought, and that the volume of feed is reduced during the succeeding years even faster than the dying out occurs, due to a reduction in growth.

During a three-year drought the stand of the forage on ungrazed range may be reduced 40 per cent, and the density of the grass is not improved until at least one year after the drought, since it is so much reduced in vigor. On the tobosa range there was found to be less dying out of the grass, amounting to only 30 per cent in the third year of the drought, but the volume of forage is affected more directly by the moisture received.

Overgrazing of the grama grass range was found to cause a great reduction in the density of the grass, especially during the growing season, and plant species of less forage value replaced it. By reducing the carrying capacity of grama grass range to one-half the yearlong rate during the growing season, it was possible to maintain the grazed range in about the same condition as the ungrazed range.

Tobosa grass range may apparently be grazed heavily during the growing season, whether or not there is a drought, without affecting the yield materially. This grass is also of little nutrient value after it is dry; therefore, the tobosa grass should be used for summer and fall range and grama grass for the other seasons of the year.

In studying the grazing capacity of the ranges during the drought of 1916 to 1918 it is noted that while the grazing capacity was not reduced during the first year, it is advised, with prospects of further dry years, that the grazing be reduced about 15 per cent, with a reduction of 35 to 40 per cent during the second year and 50 per cent during the third year, or for this range allowing during normal years 27 acres per cow, during the first year of the drought 32.2, during the second year 45.7, and during the third year 54 acres per cow. Supplemental feeding is also suggested in case of continued drought, as well as in normal years, to keep losses at a minimum and to keep the stock in condition to produce a good calf crop. During dry years about the same proportional reductions are suggested for the summer pastures of tobosa grass.

To manage the cattle so that they can be increased in good years and decreased in poor years it is suggested that the breeding herd should be limited to the grazing capacity of the range during drought, i. e., one-half the capacity in normal years, and let the number of steers kept fluctuate according to the season. In managing the breeding stock, the cows in poor condition should be separated and placed in a better pasture, as necessary, or placed in a new pasture before the rest of the herd.

Watering places should not be over 5 miles apart, or the pasture around each will be injured and that which is further away will be wasted. This also makes it too far for cattle in poor condition to go for food. To prevent overgrazing around watering places it is also suggested that the stock be put on new ranges in small bunches at different places, that salting places be established where it is desired that the cattle should go, and that the cattle be driven back toward their range when necessary. If a large number of stock are found to frequent one watering place, it may be necessary to close off the water there for a short time. The greatest benefits to the range cattle production in this territory must come through improving the grade of stock, increasing the calf crop, decreasing the loss of stock, and increasing the growth of young stock.

To study the possibilities of improving the grade of stock, 500 head were selected from the 1,950 breeding cows on the range in 1915, and 10 to 15 per cent of these were culled each year and replaced with good young heifers. Some culling was also practiced in the main herd. Only purebred Hereford bulls have been purchased and used since 1915, the best ones being used with the special herd of 500. Such good results were being obtained in the offspring that in 1919 the herd was again culled and a new herd obtained, composed of 67 head from the original 500 head herd, 174 heifers, offspring of the original 500 herd, and 146 heifers from the main herd of about 1,200. By studying the calf crop produced by the special 500 herd and the main herd it was found that the average per 100 cows per year from 1916 to 1919 was 70.3 and 55.2, respectively, as compared with 37.5 as estimated for the outside range.

The causes of the better calf production are mainly attributed to getting the cows in good condition at breeding time, weaning the calves early, separating breeding stock and nonbreeding stock, keeping only cows over 20 months and under 12 years in the breeding herd, keeping the bulls in good condition for the breeding season (July and October), and taking precautions to see that they were well distributed among the cows (4 bulls to 100 cows).

The heavy losses of cattle in southern New Mexico are attributed mainly to starvation, diseases, poisonous plants, and predatory animals. The losses from starvation were reduced on the Jornada Range to an average, from 1916 to 1919, of 1.2 and 0.2 per cent in the main herd and the special 500 herd, respectively, as compared with 16.7 per cent as estimated for open range during

those years. The main causes for the reduction in losses from starvation are attributed to having fresh forage in reserve for the cows in poor condition, proper distribution of watering places, weaning of calves during early winter at 6 to 10 months of age, and segregating, and supplemental feeding of calves and poor cows on cane silage, cottonseed meal, and soapweed. The feeding of calves from May to December is also advised to prevent stunting, which is common at this season.

The losses from diseases on this range were mainly from blackleg, which was practically prevented by proper vaccination. Scabies, ticks, and lice have tended to cause poor condition in some of the stock. Rattle-weed loco and blue woolly loco occurring on the range cause some loss, but the cattle do not appear to eat the rattle-weed until other forage is short. The loss from predatory animals does not seem to be serious. The total losses among all classes of stock on the Jornada Range were for 1915, 1.9 per cent; 1916, 1.5; 1917, 1.8; 1918, 3.5; and 1919, 1.5 per cent, or a yearly average of 1.9 per cent, as compared with 10, 12, 15, 35, 5, and 16 per cent, respectively, for southern New Mexico.

Experiments in crop utilization, G. T. RATLIFF (U. S. Dept. Agr., Dept. Circ. 209 (1922), pp. 36-38, fig. 1).—Continuations of the trials at San Antonio, Tex. (E. S. R., 43, p. 171), to determine the value of oats for winter pasture and Sudan grass for summer pasture for beef cattle are reported for 1919 and 1920.

On November 20, 1918, the two steers from the 1918 experiments, weighing 850 and 830 lbs., respectively, were turned on 2 acres of oats about 12 in. high, which had been seeded on September 25. On May 19, 1919, at the time of removal from the pasture, the steers weighed 1,145 and 1,111 lbs., respectively, and were well finished. The average daily gain for this period was 1.6 lbs.

On June 11, 1919, two yearling Red Polled steers weighing 517 and 510 lbs., respectively, were placed on 2 acres of Sudan grass seeded on March 22. On December 1 the steers weighed 718 and 680 lbs., having made an average gain of 185 lbs. per acre. This pasture also yielded two cuttings of hay which totaled 5,268 lbs. per acre. The steers were turned on 2 acres of Texas Red Rustproof oats upon removal from the Sudan grass. The oats had been seeded on October 2, 1919, and were about 10 in. high at the time the steers were turned on them. The pasturing period ended on May 17, 1920, but during the winter the oats were heavily infected with leaf rust and suffered from frost so that it was necessary to feed Sudan grass hay in dry lot for 48 days.

During the 119 days on oat pasture the steers gained a total of 212 lbs., and during the 48 days in dry lot they gained 245 lbs. These same steers on 2 acres of Sudan pasture from May 24 to July 8 gained 85 lbs., and they were in excellent condition for marketing at the end of this time.

It was calculated that the oat pasture in 1919 showed a return in beef of \$28.80 per acre, or \$8.70 per ton, and in 1920 only \$4.88 per ton. The returns from the Sudan pasture in 1919 were calculated at \$26.34 per acre for the two cuttings and \$18.50 for beef, or a total of \$44.84 for beef and hay, as compared with \$80 per acre for hay alone on the basis of average yields on other parts of the farm.

Feeding experiments, R. C. CALLOWAY (*Louisiana Stas. Rpt. 1921, pp. 26, 27*).—Blackstrap molasses fed with grain to young calves was found to be not only nutritious but a good appetizer, to have a tonic action, make the grain more palatable, and improve the quality of the skin and hair. It was also concluded that sugar-cane molasses fed with grain, as was done in this experiment, is not laxative. The average cost of raising a calf to six months of age was \$54 with molasses and \$64 without molasses.

In an experiment in feeding ground rough rice as 80 per cent and cottonseed meal as 20 per cent of the concentrates, six cows consumed an average of 9.7 lbs. of concentrates per day for the 60-day feeding period and produced an average of 22.5 lbs. of milk. Six other cows on a check ration of corn meal, cottonseed meal, and wheat bran consumed an average of 10.4 lbs per day and produced 24.5 lbs. of milk.

Pifine meal, which is made from Paille Fine grass, is being mixed with molasses and compared with alfalfa hay. In preparing the meal the grass is cut, sunned, ground, dried in steam rolls, and mixed with molasses, of which it will absorb as much as 70 per cent of its weight.

[Experiments in feeding beef cattle at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 170 (1922), p. 13*).—In continuing experiments with corn silage as a basic part of a winter ration for beef cows (*E. S. R., 44, p. 769*), the 10 years' work has shown that average beef cows will consume from 50 to 60 lbs. of corn silage and 1 lb. of cottonseed meal or linseed meal per day. Oat straw replacing the corn silage cheapens the ration, but is not desirable as more than one-third of the roughage fed. In comparing the merits of corn stover, oat straw, and mixed hay as supplements to corn silage and cottonseed meal for maintaining weight in beef cows, these feeds were found to rank in the order named, due to the cheapness and the amount required to maintain the weight.

The summary of a 2-year steer feeding test with and without corn grain other than that in corn silage showed that it was more economical not to feed corn to steers when it is high in price if silage is being fed. About equal results were obtained with cottonseed meal and linseed meal as protein supplements. The following table gives the data presented on the five lots of steers fed:

Average daily feeds consumed, gains made, cost of gains, and selling price of steers in fattening tests.

Lot	Daily ration					Average daily gain.	Cost of gain per pound	Selling price per pound
	Corn silage	Corn stover	Shelled corn	Cottonseed meal	Linseed meal			
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Cents.	Cents.
1	31.67	0.66	11.60	3.26	—	2.27	21.01	9.88
2.	45.00	.75	110.10	3.27	—	2.10	18.71	9.68
3.	47.06	.81	19.62	—	3.36	2.44	16.86	10.15
4.	55.68	.79	—	3.26	—	2.23	16.50	9.75
5.	54.95	.84	—	—	3.36	2.14	16.61	9.70

¹ Fed last 56 days of feeding period in 1919-20 and last 84 days in 1920-21

Digestibility of the sugars, starches, pentosans, and proteids of some feeding stuffs, G. S. FRAPS (*Texas Sta. Bul. 290 (1922), pp. 5-27, figs. 2*).—This bulletin contains tables showing the proteid, sugar, starch, and pentosan content, as well as the digestibility of these substances, as determined from the feeds used in the digestion experiments previously noted in three Texas bulletins (*E. S. R., 31, p. 862; 37, p. 865; 42, p. 368*).

Determinations of the pentosan included that which was soluble and insoluble in the nitrogen free extract and that which was in the crude fiber. The residual nitrogen-free extract was determined by adding together the sugars, starch, and pentosans in the nitrogen-free extract and subtracting this sum from the total nitrogen free extract. The total protein less proteids was

termed amids or nonproteids. Classifying the feeds into nonleguminous hay and forage, leguminous hay, starchy concentrates, and cottonseed products, rice bran, and corn bran, the average digestibility was determined as follows:

Average coefficients of digestibility for various feeding stuffs by groups.

Kind of feeding stuff	Protein		Starch	N-free extract		Pentosans.			Total.
	Non-proteids	Pro-teids		Total residual	Soluble residual.	Soluble in N-free extract	Insoluble in N-free extract.	In crude fiber.	
Nonleguminous hay and forage.....	66.2	37.9	76.2	40.8	43.9	59.7	54.6	56.5	54.2
Legume hays.....	85.7	68.1	89.7	61.4	72.3	74.4	34.9	54.1	52.4
Starchy concentrates.....	34.9	81.8	97.4	22.9	26.4	100.0	54.8	18.2	68.7
Cottonseed products, rice bran and corn bran.....	76.9	66.9	91.1	47.2	50.0	.....	81.1	38.6	76.7

Digestion experiments, G. S. FRAPS (*Texas Sta. Bul. 291 (1922), pp. 5-16, figs. 2*).—This publication gives the composition, the productive values, and the results of digestion trials with two sheep on the feeds tabulated below. The methods of conducting the trials were the same as for those experiments previously reported in Bulletin 245 (E. S. R., 42, p. 368). The averages and comparative data previously reported from this and other stations, as well as the composition of wheat by-products already noted (E. S. R., 47, p. 69), are not included in this abstract.

Productive values of feeds and percentage digested by sheep

Trial No.	Kind of feeding stuff	Digestion coefficient				Productive values		
		Protein	Other extract	Fiber	N-free extract.	Ash.	As fat	As therms.
111	Alfalfa.....	75.52	42.57	39.78	72.22	51.51	9.10	38.99
116	do.....	72.06	37.15	36.74	72.76	47.54	9.18	39.33
122	Alfalfa hay.....	77.29	32.06	39.29	71.66	60.40	9.28	39.75
131	Alfalfa meal.....	73.87	21.50	58.93	73.60	56.15	9.36	40.10
107	Cottonseed hulls, de-linted.....	.....	76.10	36.10	63.00	.....	8.46	36.26
109	Corn bran.....	87.13	90.66	68.15	81.79	58.50	16.54	70.87
129	Barso seed.....	72.50	87.20	80.65	82.20	46.12	20.37	87.27
130	Milo seed, whole.....	87.88	88.20	72.30	95.61	73.40	21.22	90.91
132	Milo seed, ground.....	81.00	91.20	2.28	95.90	31.09	21.02	90.08
125	Oats, rolled.....	90.16	95.66	79.95	98.10	41.65	23.19	99.34
126	Oats, whole.....	79.28	89.66	59.63	84.45	20.50	16.56	70.93
124	Oat-hull clippings.....	42.70	57.80	76.15	68.55	13.03	10.05	43.06
133	Oat meal mill by-products.....	61.55	74.72	30.18	55.84	23.11	7.22	30.93
108	Peanut hulls.....	13.18	60.70	34.40	88.00	2.00	2.61	11.31
127	Pinto beans.....	87.15	64.75	61.64	95.65	50.62	19.76	84.65
121	Sorghum seed (red top).....	56.55	56.43	100.00	87.38	50.28	17.73	76.77
128	Vetch beans in pods.....	76.04	98.10	95.47	96.55	75.06	16.50	70.68
120	Sesame cake.....	90.94	61.15	39.48	29.55	19.58	17.43	74.68
117	Wheat, whole.....	92.17	91.04	90.14	96.00	70.23	20.81	89.18
118	Wheat, cracked.....	90.31	86.46	88.15	96.15	82.12	.....	.....
112	Wheat bran.....	85.97	77.21	42.66	71.63	40.46	12.24	52.48
114	do.....	82.58	64.06	44.05	80.27	39.61	13.17	56.42
113	Wheat, brown shorts.....	88.89	82.73	51.91	90.55	51.68	19.06	81.65
119	do.....	89.25	83.63	70.65	83.35	37.09	18.16	77.79
115	Wheat, gray shorts.....	82.57	95.50	.....	89.62	28.62	18.42	78.90
123	Wheat, white shorts.....	88.00	91.54	33.50	98.87	70.06	21.55	92.31

Commercial feeding stuffs, E. G. PROULX ET AL. (*Indiana Sta. Bul.* 260 (1922), pp. 16, fig. 1).—The annual report for 1921 on commercial feeding stuffs in Indiana (E. S. R., 45, p. 266) discusses the amount and value of compounded feeds and straight by-product feeds used yearly from 1914 to 1921 in that State. The estimated sales, average retail price, and average analyses of the following feeds are given: Alfalfa meal, animal by-products (tankage, meat scrap, etc.), brewers' dried grains, coconut oil meal, corn bran, corn feed meal, corn germ meal, corn gluten meal and feed, cottonseed meal, cottonseed feed, distillers' dried grains, dried buttermilk (milk by-products), hominy meal and hominy feed, linseed oil meal, unscreened flaxseed oil feed, corn, oat, and miscellaneous chops, the usual wheat feeds, and the proprietary stock and poultry feeds.

The manufacture of wheat mill feeds is described, and the limits for the different wheat feeds are given, based on the fiber content as suggested by the American Association of Feed Control Officials. The methods of preparation and manufacture of tankage and animal by-products are also discussed.

Sheep breeding experiment (*New Hampshire Sta. Bul.* 203 (1922), pp. 9, 10).—This is a progress report of the results of the genetic studies in crossing Southdown sheep with Ramboulllets and Hampshires under the direction of E. G. Ritzman, with the idea in view of developing a better strain of wool-and-mutton sheep. The offspring have now been carried to three generations, and it will soon be possible to make predictions on the applicability of Mendel's law in sheep breeding. Several individual crosses between Oxfords and Ramboulllets have also given promising results as to size and quality of wool.

[**Experiments in sheep production at the Pennsylvania Station**] (*Pennsylvania Sta. Bul.* 170 (1922), pp. 14, 15) —Six years' work is reported, continuing the preliminary data given (E. S. R., 44, p. 72) on the results of crossing Merino ewes with mutton rams, with little or no change in the conclusions previously given.

In comparing a grain ration of 300 lbs. whole oats, 100 lbs. wheat bran, and 50 lbs. oil cake with a ration composed of 150 lbs. cracked corn, 300 lbs. whole oats, 100 lbs. wheat bran, and 50 lbs. oil cake for wintering purebred Shropshire and Merino ewes receiving corn silage and mixed hay, it was found that the ewes receiving the ration containing the corn were in better condition at lambing time than the other ewes, but they did not produce as much milk nor did they raise as large a percentage of their lambs.

Experiments in docking and castrating lambs showed that there was practically no difference in the rate of gain of lambs docked with an emasculator or with hot pincers, though healing seemed to be more rapid when the emasculator was used. Castrating at the time of docking did not seem to interfere with the rate of growth.

Grain sorghums v. corn for fattening lambs, J. M. JONES and R. A. BREWER (*Texas Sta. Bul.* 285 (1922), pp. 5-23).—This is a more complete report of work noted from another source (E. S. R., 45, p. 471). Among the added material in this paper are the results of two other lots of lambs composed of 15 lambs each, one lot of which was fed on ground milo, alfalfa hay, and whole cotton seed instead of cottonseed meal, and the other lot on ground milo, cottonseed meal, and sorghum hay instead of alfalfa. These lots made respective average daily gains of 0.34 and 0.257 lb. Analyses of the feeds used, as well as determinations of Fraps' productive values, are also included.

[**Hog feeding experiments at the Pennsylvania Station**] (*Pennsylvania Sta. Bul. 170 (1922), pp. 13-14*).—Tests comparing rape, rape and oats, and rape, oats, and Canadian field peas for pigs showed that rape was superior to the other crops with regard to gains produced, length of pasture period, and cost of establishing pasture.

In comparing rations for fattening swine during a 130-day fattening period, a ration composed of corn, buckwheat middlings, and tankage (60 per cent protein) produced the greatest gain, but was not as economical as rations of corn and wheat middlings with tankage containing either 50 or 60 per cent protein.

With two lots of 25 pigs each which had access to rape pasture, self-feeding, one lot produced an average daily gain of 1.52 lbs. at a cost of 18 cts. per pound, whereas with hand feeding the other lot made an average daily gain of 1.47 lbs. at a cost of 13 cts. per pound.

Notes are also given on comparative rations for wintering brood sows and protein supplements to corn for fattening swine which have been previously noted (E. S. R., 45, p. 676).

Rice bran for fattening hogs, D. W. WILLIAMS and O. E. MCCONNELL (*Texas Sta. Bul. 286 (1922), pp. 7-15*).—In studying the feeding value of rice bran for fattening hogs, 94 Duroc-Jerseys were selected which were divided into 12 lots. Lots 1 to 6 had been previously grazed on peanuts for about 25 days, and lots 7 to 12 had not been on the peanuts. Due to a prolapse of the rectum and a hernia, it was found necessary to discard one pig from lot 5 and one from lot 11 during the test.

The average of weights taken on 3 successive days at the beginning and end of the test were considered as the initial and final weights for the 75-day feeding period. The following table shows the results of the test. It will be noticed that 2 lots of pigs were fed on each ration, 1 lot in each case being from the peanut pasture. All lots had access to a small run during the test:

Summary of feeding trials with rice bran, corn chops, and tankage.

Lot	Number of pigs	Ration fed			Average weight per head		Average daily gain per head	Feed per 100 pounds gain.		
		Corn chops	Rice bran.	Tank-age	Initial.	Final.		Corn chops.	Rice bran.	Tank-age
		Per ct	Per ct	Per ct	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	7	90	...	10	158.0	298	1.86	401.4	...	44.6
2	8	90	...	10	127.5	256	1.70	375.3	...	41.7
7	7	...	90	10	155.0	253	1.28	...	449.1	49.9
8	8	...	90	10	126.0	217	1.21	...	456.3	50.7
3	7	45	15	10	158.0	270	1.49	247.0	247.0	55.0
9	8	45	45	10	126.0	252	1.68	195.3	195.3	43.4
1.	7	(1)	(1)	(1)	159.0	311	2.02	506.0	47.0	6.0
10.	8	(1)	(1)	(1)	128.0	268	1.86	491.0	29.8	9.2
5.	6	30	60	10	160.0	281	1.60	148.5	297.0	49.5
11.	7	30	60	10	131.0	240	1.44	147.6	295.2	49.2
6	7	60	30	10	162.0	299	1.83	282.6	141.3	47.1
12.	8	60	30	10	126.0	254	1.70	253.8	126.9	42.3

¹ Self-fed

Rice bran fed alone with tankage was not satisfactory, since it was unpalatable, too bulky, and produced the poorest gains. However, with corn chops and tankage fairly good results were obtained.

At the close of the above test 3 hogs from each lot were shipped for slaughter to the U. S. Experiment Station at Beltsville, Md. and the rest to Swift & Co

at Fort Worth, Tex. The carcasses at both places were graded after chilling for 48 hours, and samples of leaf and back fat were taken for determinations of melting points. Iodin numbers were also reported on the fat from each hog by Swift & Co.

The following number of carcasses in the different lots were graded as soft by Swift & Co.: Four in lot 2, 5 in lot 8, 1 in lot 9, 2 in lot 5, 1 in lot 11, and 1 in lot 6, and by the U. S. Experiment Station 2 in lot 8 were reported as slightly soft. From the tests on the carcasses it would appear that rice bran can be fed as from 50 to 60 per cent of the ration with corn chops and 10 per cent tankage without the production of soft fat to any great extent. At the beginning of these tests 4 of the 94 hogs were killed, 2 having been grazed on peanuts. These carcasses were all graded as hard.

Analyses of the feeds used are reported.

Soft pork investigations (*Georgia Sta. Rpt. 1921, pp. 9-11, fig. 1*).—A two-months feeding period of corn and tankage or cottonseed meal was found not to harden the soft and oily fat of hogs fed on peanuts, though potatoes fed in a finishing period gave some promising results. A classification of the firmness of the carcasses in the cooling room was found not to coincide entirely with the hardness of the body fat as determined by the melting point and iodine number.

[**Report on poultry work at the New Mexico Station**] (*New Mexico Sta. Rpt. 1921, pp. 34-40*).—The poultry experiments during 1921 consisted of a continuation of all the projects from 1920 (*E. S. R., 46, p. 370*) with the exception of the cockerel feeding experiment.

In the cottonseed-meal feeding experiment five pens of 7 Rhode Island Red pullets each were fed equal amounts of scratch feed of equal parts of milo and barley and a mash which was kept before the pullets at all times. The following table shows the results obtained:

Results of cottonseed-meal feeding experiments with pullets.

Pen No.	Proportion of feeds in mash						Total feed per pen	Cost of feed.	Number of eggs produced.	Feed cost per dozen eggs	Weight of pen.	
	Wheat bran	Ground oats	Corn chop	Alfalfa meal.	Dried meat scrap	Cotton-seed meal					Jan. 1.	June 30.
	<i>Parts</i>	<i>Parts</i>	<i>Parts</i>	<i>Parts</i>	<i>Parts</i>	<i>Parts</i>	<i>Pounds.</i>			<i>Cents</i>	<i>Pounds.</i>	<i>Pounds.</i>
10	7.5	7.5	7.5	7.5	10		326.27	\$8.16	626	15.63	38.50	35.25
11	5.0	5.0	5.0	5.0		20.0	304.53	6.64	641	12.43	34.75	31.00
12	7.5	7.5	7.5	7.5		10.0	325.41	7.05	571	14.82	37.13	35.75
13	7.5	7.5	7.5	7.5		3.3	342.83	7.44	543	16.45	36.63	29.00
14	20.0				20.0		358.31	7.18	613	14.05	32.88	33.00

In the artificial lighting project the lights were turned on at 3 a. m., beginning November 1, and gradually turned off during April. The total eggs laid by the lots receiving artificial lights were 4,277, as compared with 4,507 for the other lots. The lighted lots, however, reached the highest point of production during January and laid more eggs when eggs were scarce.

The incubation project showed the importance of the humidity, as where there were maximum, medium, minimum, and dry moisture conditions the hatching percentages of fertile eggs were, respectively, 52.66, 38.01, 44.78, and 10.69 per cent. The percentage condition of the chicks was, respectively, 91, 97.5, 98, and 55.

The results of the first New Mexico egg-laying contest for 1921 are also given.

Practical points in poultry breeding, G. W. HERVEY (*New Jersey Sta., Hints to Poultrymen*, 10 (1922), No. 9, pp. 4, fig. 1).—Brief notes are given on the practical importance of observing the standard points of birds used for breeders; trap-nest records of breeders, especially during the winter months; a comparison of trap nesting and culling; having the breeding stock in good condition during the breeding season and not weakened by forced winter production by too much artificial lighting; and good management and care in selecting the cockerels for breeding, by pedigree and performance of their ancestors. A discussion is also given of line breeding.

Summer production in the laying pens, R. R. HANNAS (*New Jersey Sta., Hints to Poultrymen*, 10 (1922), No. 8, pp. 4, fig. 1).—This gives practical directions for maintaining a good summer egg production. The most important factors seem to be in getting the birds to eat plenty of mash (from one and one-half to two and one-half times as much mash as scratch feed) and having plenty of green feed available. Notes are also included on the care of the birds, houses, and early hatched birds during the summer.

Handling cockerels as broilers, G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, pp. 9-12, figs. 2).—Directions are given for quick and efficient fattening of cockerels in fattening crates, and cost data obtained in a test in 1918 are reported.

One cause of baby chick losses, Mrs. G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, pp. 7, 8).—Suggestions are given for selecting hens for breeders, it being suggested that one of the main causes of baby chick losses is due to poor breeding stock.

Natural incubation and brooding, W. F. SCHOPPE (*Montana Sta. Circ.* 103 (1922), pp. 8, figs. 3).—This is a revision of Circular 74, previously reported (*E. S. R.*, 39, p. 781).

Experiments show inbreeding effects (*Wisconsin Sta. Bul.* 339 (1922), pp. 116-118).—The results of an experiment conducted by L. J. Cole and J. G. Halpin on inbreeding Rhode Island Reds from 1912 to 1916 showed that when selection was made only for color with brother and sister mating, the hatchability of the eggs and the viability of the flock deteriorated until no adult birds were obtained in 1916. Mating brother and sister from 1917 to 1921, but selecting for hatchability of the eggs and vigor, resulted in no deterioration of the flock during this time.

The germ cells (*Wisconsin Sta. Bul.* 339 (1922), pp. 118-120).—Efforts at controlling sex in rabbits have proved negative. In attempts to modify the germ plasma of animals with radium there has been a production of sterility but no demonstrable modification of offspring. Studies by S. V. Jones have added new light on the inheritance of black and blue in the plumage of pigeons.

DAIRY FARMING—DAIRYING.

Feeding standards for milk production, W. B. ELLETT, C. W. HOLDAWAY, and W. G. HARRIS (*Virginia Sta. Tech. Bul.* 23 (1921), pp. 52).—Experiments carried on from 1912 to 1917 in studying the requirements of protein and net energy, as well as carbohydrates and fats for milk production, are reported, including those previously noted (*E. S. R.*, 43, p. 874). In making this study mature Holstein cows, not bred, were divided into three groups, as uniform as possible as to milking capacity, composition of milk, stage of lactation, etc. One group was to be fed for 50 days on each of the following types of ration: Basal

ration which was computed to supply sufficient digestible protein and energy for maintenance and milk production according to Armsby, basal carbohydrate ration which consisted of the basal ration plus 1 lb. of cornstarch, and basal protein ration which consisted of the basal ration plus 1 lb. of protein derived from blood, commercially called black albumin.

The addition of the cornstarch and black albumin during the first two years was in proportion to the milk production. After the first year the feeding stuffs used in the basal ration were cottonseed meal, gluten meal, bran, corn meal, and corn silage. During the first two years the length of the feeding periods varied, but during the later years they were 50 days in length and were divided into subperiods of 10 days, during the last one of which digestion trials were made. Daily samples of the feeds, milk, feces, and urine were taken either for composite or daily analysis.

Detailed results are reported in tabular form, showing for each cow and averages for the cows on each ration the protein and energy in the food consumed, milk produced, and the estimated amount required for maintenance; daily gain or loss in live weight; daily results on protein utilization during the digestion trials; analyses and amount of feed consumed, milk produced, and excrements; nitrogen balances; digestion coefficients; protein and energy in the rations, in milk, and for maintenance; and ratio between energy and protein available for milk production. All data on the maintenance requirements of the cows are estimated according to the common standards. The following table shows the economy of production according to the amount of protein, carbohydrates, fat, and energy required to produce 1 lb. of milk on the different rations. This table is divided into two parts, the first part including all the animals used and being based on averages reported, such as standard maintenance requirements, digestible coefficients, etc., as given by Henry and Morrison. The second part is based only on cows on which digestion trials were performed. The same maintenance value and digestion factors were used, but the amount of protein used for body gain or loss was determined from the nitrogen balances.

Economy in use of feeds on basal, basal carbohydrate, and basal protein rations for milk production per cow

Ration	Averages of all tests, 1912-1917						Average of all cows in digestion trials				
	Daily gain or loss in live weight	Daily milk produced	Average amount in feed required to produce 1 lb. of milk				Number of cows	Average daily dry matter consumed in feed	Daily nitrogen balance	To produce 1 lb. of milk	
			Digestible protein	Digestible fat	Digestible carbohydrates	Net energy				Protein above maintenance	Energy
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Therms.		Lbs.	Lbs.	Lbs.	Therms.
Basal.....	-0.10	29.05	0.053	0.0190	0.207	0.3155	8	23.792	+0.035	0.046	0.322
Basal carbohydrate.....	+ .10	27.88	.055	.0198	.239	.3580	11	24.978	.040	.044	.392
Basal protein.....	+ .36	29.55	.075	.0189	.200	.3363	11	24.881	.062	.053	.353

In the third part of the work similar data are reported for the individual cows on the digestion trials which were considered as normal, and computations are based on the actual digestion coefficients obtained with each indi-

vidual animal. The results with cows which showed that the nutrients digested were in excess or lacking or that did not maintain the milk flow were considered abnormal and discarded.

The results with normal cows, the summary of which includes 6 cows on the basal ration, 4 on the basal carbohydrate ration, and 8 on the basal protein ration showed respective requirements of 0.042, 0.037, and 0.046 lb. of digestible crude protein to produce 1 lb. of 3.5 per cent milk. The other results are also similar to those reported in the table above.

On the basis of the results of these trials a new feeding standard is suggested for dairy cattle, based on the amount of milk produced and the percentage of butter fat in the milk. In this standard "the amounts of digestible protein are about 25 per cent higher than Armsby's, 12 per cent higher than Haecker's, and 10 per cent lower than Savage's standards." For maintenance, allowances of 0.5 lb. of digestible crude protein and 6 therms of energy are made per 1,000 lbs. of live weight.

Can "home-grown rations" supply proteins of adequate quality and quantity for high milk production? III, E. B. HART and G. C. HUMPHREY (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 305-311). -In continuing the studies previously noted (E. S. R., 45, p. 71), three dairy cows were fed on the following daily rations: A barley ration consisting of 10 lbs. of barley, 10 lbs. of alfalfa, and 30 lbs. of corn silage, having an energy value of 16.37 therms; a corn ration consisting of 10.6 lbs. of corn meal, 10 lbs. of alfalfa, and 30 lbs. of corn silage, having an energy value of 17.24 therms; and an oat ration consisting of 9.1 lbs. of whole oats, 10 lbs. of alfalfa, and 30 lbs. of corn silage, with an energy value of 14.43 therms. The protein content of each of these rations was equal. The three cows used were producing from 25 to 48 lbs. of milk per day and each cow was run on each ration for four periods of one week each, during which the nitrogen balance was determined.

It was found with the three animals that the difference in the energy value of the three rations was sufficient to determine a positive or negative nitrogen balance, as a positive nitrogen balance was produced with the barley and corn rations and a negative nitrogen balance with the oat ration. It is concluded, however, that satisfactory rations may be made up from home-grown feeds.

[Feeding experiments with dairy cattle] (*Pennsylvania Sta. Bul.* 170 (1922), pp. 20, 21).-- A comparison was made with 16 cows of the milk producing value of buckwheat middlings and gluten feed when each composed one-half of a ration. It was concluded that although the gluten feed proved slightly superior, buckwheat middlings may be substituted for all or part of the gluten feed without seriously affecting milk production.

In an 8 weeks' feeding trial with 12 cows, silage composed of two-thirds red clover and one-third timothy was found superior for milk production to a ration in which the roughage was composed solely of hay. A 6 weeks' feeding test, using 16 cows divided into two groups, showed that one group produced 3.59 and 3.32 lbs. of milk per pound of grain with corn silage and with Canada field pea-and-oat silage, respectively, included in the ration, whereas the other group produced 3.31 and 3.55 lbs. of milk per pound of grain with oat-and-pea silage and corn silage, respectively, in the rations.

In 2 years' feeding trials with corn silage compared with soy bean silage and silage composed of 30 per cent green soy bean forage and 70 per cent green corn forage, it was determined that there was practically no difference in the milk producing value of the silages.

Two lots of 7 cows each, fed on corn silage and sunflower silage, respectively, showed that the corn silage was superior for milk production. The sunflower

silage was unpalatable. In another trial silage composed of one-half corn forage and one-half sunflower forage was superior to sunflower silage, but inferior to corn silage.

[Feeding experiments with dairy cattle] (*Wisconsin Sta. Bul. 339 (1922)*, pp. 129, 130, 132-135).—Notes are given on the studies on home-grown rations for dairy cattle, noted on page 478, with some additional data.

The experiments on the use of hydrolyzed sawdust for dairy cows (E. S. R., 45, p. 275) are briefly noted, and the possibilities of the future importance of this feed are mentioned.

Calf feeding experiments by F. B. Morrison, R. S. Hulse, and G. C. Humphrey resulted in average daily gains of 1.48 lbs. for calves fed on whey and a concentrate of 30 lbs. of corn, 30 lbs. of middlings, and 40 lbs. of linseed meal. Similar gains were made by calves fed skim milk or a minimum amount of whole milk.

In E. B. Hart and H. Steenbock's metabolism experiments with dairy cows and milch goats, they have shown that a greater amount of calcium seems to be consumed when cod liver oil or fresh green alfalfa is included in the feed. The indications seem to be that vitamin A assists in the calcium assimilation. However, in one trial with butter fat, which is rich in vitamin A, no improvement was observed in the assimilation of calcium.

Soy beans as a home-grown supplement for dairy cows, A. C. McCANDLISH, E. WEAVER, and L. A. LUNDE (*Iowa Sta. Bul. 204 (1922)*, pp. 47-52).—Feeding trials using soy beans and linseed oil meal as protein supplements to home-grown feeds for milk production were made with 4 and 5 cows, respectively, during the winters of 1919-20 and 1920-21. Each trial was divided into three periods of 30 days each, the first 10 days of which were considered as transition periods. A basal ration of corn silage, alfalfa hay, and a grain mixture of equal parts of cracked corn and ground oats was fed during the entire tests.

In both years this basal ration was supplemented with old process linseed meal during the first and third periods and with soy beans during the second period. The milk and fat production of the cows was averaged for the first and third periods and compared with the production of the second period. The system of feeding as far as possible consisted of allowing enough roughage for the maintenance of the animals and supplying grain according to the production. About 2 lbs. of protein supplement was fed to each 3 lbs. of the basal grain ration. Only average results for each trial are reported as to the milk and fat produced and feed consumed, as shown in the following table.

Feed consumed and milk and fat produced in trials on protein supplements

Year	Protein supplement	Average live weight of cows.	Feed consumed				Milk and butter fat produced		
			Corn silage.	Alfalfa hay	Grain mixture	Protein supplement.	Milk yield.	Fat content.	Fat yield.
		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.	Pounds.
1919-20.	{Oil meal..	1,049	2,130	420	365	213	1,350.2	4.47	60.30
	{Soy beans.	1,037	2,100	420	386	193	1,268.1	5.12	64.90
1920-21.	{Oil meal..	988	2,512	596	598	398	2,143.1	4.19	89.45
	{Soy beans	987	2,309	557	598	398	2,076.9	4.62	90.04

Cracked soy beans were found to give higher returns in the form of butter fat, due to a higher percentage of fat in the milk, though less milk was produced than by oil meal. From the average results of the two trials it is calculated that with oil meal worth \$45 per ton soy beans are worth \$60 per ton and are a valuable home-grown source of protein for milk production. Comparative analyses of the two supplements used showed that the soy beans were somewhat higher in crude protein, much higher in fat, but lower in nitrogen-free extract than the oil meal.

[**Silage from late and early corn**] (*Ohio Sta. Bul. 353 (1921), p. XIII*).—A study of the relative values of silage from ordinary field corn (Clarage) and large silage corn (Blue Ridge) is briefly noted, in which it was found that the nutritive value of the Clarage silage was 4 per cent higher, but the yield per acre was 9 per cent lower and the milk production was 4 to 5 per cent lower than with the Blue Ridge silage.

[**Peanut feed for dairy cows**] (*Georgia Sta. Rpt. 1921, p. 9, fig. 1*).—"Heavy feeding of peanut meal was found to change the properties and composition of butter fat only slightly. Equivalent amounts of whole peanuts produced a harder fat with a higher melting point, although the iodine number was lowered."

[**Cost of milk production**] (*Wisconsin Sta. Bul. 339 (1922), pp. 63-65, fig. 1*).—Studies in the cost of milk production by S. W. Mendum and H. Keller during 1920, based on the units of feed required, units of feed consumed, and milk produced in groups of cattle from five different counties, showed that most of the cattle were consuming slightly more feed than was required, and also showed a more economical use of feed in relation to milk produced by the high producing cows.

[**Judging the dairy cow**, H. E. McNATT (*Western Washington Sta. Bimo. Bul., 10 (1922), No. 1, pp. 19-23, figs. 6*).—The principles of judging dairy cows are mentioned, and a suggested score card is given to bring out the more important points to be noted in dairy cattle.

[**Work in dairy husbandry at the New Mexico Station**] (*New Mexico Sta. Rpt. 1921, pp. 40, 41*).—A progress report on the milch goat project (E. S. R., 46, p. 372) states that a total of 11 half blood and 3 three-quarter blood does have now been obtained from the purebred Toggenburg buck. The yearling half blood does now milking have produced practically as much as their dams and show much better udder development.

[**Milking machine experiments**], T. H. WRIGHT, JR. (*South Dakota Sta. Rpt. 1921, pp. 21, 22*).—The average bacterial count of the first milking with a machine was 23,478 per cubic centimeter as compared with 14,087 for the second cow milked. Leaving one set of teat cups idle in a double unit machine was found to increase materially the bacterial count of the next cow milked. Hydrated lime and a commercial disinfectant were found to be of about equal value for sterilization of the tubes.

[**Milking machines.—VII. Further studies on methods of sterilization**, A. H. ROBERTSON, M. W. FINCH, and R. S. BREED (*New York State Sta. Bul. 492 (1922), pp. 3-36*).—Continuing the series previously noted (E. S. R., 47, p. 180), experiments in sterilizing the tubes and teat cups of milking machines by high and low temperatures, chemicals, and polishing and scrubbing are reported. In determining the efficiency of the different types of sterilization the methods employed were similar to those in work previously noted (E. S. R., 41, p. 277) in that bacterial counts were made of sterile water milked from an artificial udder by the milking machine. These counts were made by the plate method after incubation for 5 days at 21° C.

Heat sterilization was found to be an efficient method for sterilizing machines equipped with rubber parts that will resist destruction by heating with hot water or live steam twice daily for a reasonable length of time. It was found, however, that the rubber of some machines would not stand such heating.

Running cold water through the tubes continuously from one milking to the next was found not to be very efficient, since in one case at least water bacteria found desirable places to multiply in the tubes. Many of the tests, however, with cold water running through the tubes indicated that it was partially effective.

Brine and chlorid of lime and commercial preparations of chlorid of lime and chloramin were used in tests on chemical sterilization, both for leaving the tubes in corks between milkings and for rinsing the tubes before or after milkings, or both.

The general results indicate that satisfactory sterilization was obtained by using chlorid of lime with a brine solution, and that no better results were obtained with the commercial preparations, though they were more expensive. Rinsing the tubes before and after milking with a chlorid of lime solution appeared to sterilize them almost as well as when they were submerged in brine and chlorid of lime between milkings. It was found that scrubbing and polishing could not be depended upon to destroy the bacteria, since a part which appeared to be thoroughly clean to the eye might be harboring large numbers of organisms.

Instructions for the cleaning and care of milking machines are appended.

Leaky valves on milking machines contaminate milk, J. D. LUCKETT (*New York State Sta. Bul. 488 pop. ed. (1921), pp. 8, figs. 8*).—This is a popular edition of the bulletin previously noted (*E. S. R., 47, p. 180*).

[**Experiments in dairying at the Wisconsin Station**] (*Wisconsin Bul. 339 (1922), pp. 20, 22-26, 27, 28, 29-31*).—The possible rôle which may be played by the methylene blue reduction test (*E. S. R., 41, p. 675*) in determining the quality of milk is discussed, and a method worked out by E. G. Hastings, A. Davenport, and W. H. Wright for making and reading the test is described. Two types of spoilage in canned evaporated milk have been observed in samples from condenseries, one causing the development of a firm curd and the other a bitter taste. Recent work by Hastings has shown that these conditions were due to spores of aerobic bacteria not killed during the canning process. It was found by H. H. Sommer that the addition of sodium citrate, sodium or potassium phosphate, and calcium chlorid to evaporated milk in the proper amounts tended to reduce the coagulation which had been occurring at some of the condenseries.

The following formula is suggested by Sommer for calculating an ice cream mix of a definite composition of fat and solids, in which A is the percentage of fat in the condensed milk product, B the percentage of solids in the condensed milk product, C the desired percentage of fat in the mixture, D the desired percentage of solids in the mixture, and X the test of the cream to be used in making the mix:

$$X = \frac{BC + 8.9A - 8.9C - AD}{0.911C + B - 0.911A - D}$$

Tests by L. C. Thomsen of a milk tester recently put on the market showed results sometimes far below the Babcock tests and at other times far above it.

To determine if there was any difference in the quality of whey butter and other butter 36 samples of milk were divided into two parts by J. L. Sammis,

one lot being skimmed and the cream made into butter, while the other lot was made into cheese, the whey skimmed, and this made into butter. The lots of butter were scored when fresh and at intervals of two or three months after the butter was made. The average score of the milk butter was 88.98 and the whey butter 90.11, showing that there was practically no difference in the quality of the two types of butter.

The results of comparisons of the different methods of paying for milk at cheese factories showed that there was a general advantage in favor of the "fat plus 2" system of paying previously suggested (E. S. R., 46, p. 879).

Germ content of milk as influenced by visible dirt, H. A. HARDING and M. J. PRUCHA (*Illinois Sta. Bul. 236, abs. (1921), pp. 4*).—This is an abstract of the bulletin already noted (E. S. R., 46, p. 373).

Problems in the manufacture of ice cream (*Pennsylvania Sta. Bul. 170 (1922), p. 22*).—In these studies it is reported that no particular brand of condensed milk gave outstandingly better results than any other brand; the ice cream mix should be homogenized and aged for 48 hours below 40° F. for best results; and improvers increase viscosity but result in "livery" mix and ice cream.

VETERINARY MEDICINE.

The Harvey lectures, 1919–1920, Ser. XV (*Philadelphia and London: J. B. Lippincott Co., 1921, pp. 157, pls. 7*).—The fifteenth series of The Harvey Society of New York lectures is as follows: Biological Standards and Their Application in Medicine, by G. Dreyer; The Nature and Cause of Wound Shock, by H. H. Dale; Chemistry of the Thyroid Secretion, by E. C. Kendall; Trench Fever, by H. F. Swift; Recent Work on Pellagra, by C. Voegtlin; Blood Analysis and Its Applications, by O. Folin; and Some Phases of the Pathology of Nutrition in Infancy, by W. McK. Marriott.

[Work by the Wisconsin Station with diseases of live stock] (*Wisconsin Sta. Bul. 339 (1922), pp. 4–16, figs. 4*).—In the course of this discussion of Johne's disease (E. S. R., 46, p. 682), which has caused long continued losses, and investigations of which are being conducted at the Wisconsin Station by E. G. Hastings and B. A. Beach, it is reported that a yearly loss of from 2 to 12 per cent has taken place in the four herds which have been under observation for a number of years. In one herd of 50 animals there was a loss from this disease during a period of 17 years of 41 head, and another herd of 18 replaced 22 animals in 10 years.

The results of testing work with johnin, commenced in 1917 and since which time its preparation has been carried on, are reported upon. Then follow discussions of tuberculosis in farm animals and the effect of ultra-violet rays on tuberculosis vaccine, abortion in sows, vaccination against contagious abortion, and the occurrence of swamp fever.

In experiments conducted by W. D. Frost and M. Schroeder with a view to determining the effect of ultra-violet light upon the tubercle bacillus, 13 animals were inoculated with an exposed suspension of the tubercle bacillus (exposed to ultra-violet light at a distance of 9 in. for 15 minutes) and two with the suspension before its exposure to the light. The two animals injected with the untreated suspension developed generalized tuberculosis, while the 13 others remained free from the disease, thus indicating the possibility of destroying the tubercle bacillus in this way.

Collected leaflets on diseases of animals (*London: Min. Agr. and Fisheries, 1922, pp. 101, pls. 6, figs. 7*).—This is a collection of papers dealing with some of the more important affections of live stock in Great Britain.

The home doctoring of goats, rabbits, and poultry, R. E. DAVIES (*London: Benn Bros., Ltd., 1921, pp. 52*).—This is a popular handbook.

Parasites of hogs, sheep, cattle, and poultry, B. M. UNDERHILL (*Penn. Dept. Agr. Bul. 354 (1921), pp. 40, figs. 22*).—A popular summary of information.

A treatise on the diseases of bovines and equines, I, II, G. and R. MOUSSU (*Traité des Maladies du Gros Bétail. Paris: Asselin & Houzeau, 1922, 4. ed., [rev.], vols. 1, pp. VIII+608, pls. 7, figs. 200; 2, pp. 470, pls. 9, figs. 165*).—In the preparation of the fourth edition of the work previously noted (E. S. R., 26, p. 485) the plan has been changed, the present volumes dealing with the larger domestic animals, and separate works on the diseases of the sheep and swine, respectively, having been issued. The work on diseases of swine has been noted (E. S. R., 40, p. 88). The present work is a revision of that part of the earlier edition dealing with diseases of bovines and equines.

Meat inspection, with special reference to toxemia, J. HENDERSON (*Vet. Rec., n. ser., 2 (1922), No. 16, pp. 269-274*).—This is a general discussion of the subject.

Digest of comments on the Pharmacopœia of the United States of America and on the National Formulary, A. G. DUMÉZ (*Pub. Health Scr. U. S., Hyg. Lab. Bul. 129 (1922), pp. XXI+377*).—This continues for 1919 the series previously noted (E. S. R., 46, p. 178).

The extraction of alkaloids from viscera, W. C. COLLEDGE (*Jour. So. African Chem. Inst., 5 (1922), No. 1, pp. 3-5*).—This is an account of experience in the extraction of the more commonly occurring alkaloids in the course of toxicological work during the past 15 or 16 years.

Carbon tetrachlorid: A drug proposed for the removal of hookworms, with special reference to its toxicity for monkeys when given by stomach tube in repeated doses, G. C. LAKE (*Pub. Health Rpts. [U. S.], 37 (1922), No. 19, pp. 1123-1126*).—The experiments reported by Hall, previously noted (E. S. R., 46, p. 282), led to the investigations here considered. It appears that carbon tetrachlorid by the stomach has a very low toxicity for monkeys, that man may safely be given considerably higher doses than the one suggested by Hall, and that it might be safe to repeat the dose several times at intervals of one week.

In an appended note the author states that he has since been notified by Hall that as high as 300 cc. of the carbon tetrachlorid has been given dogs as a single dose without causing evident toxic symptoms.

The bactericidal action upon calf lymph of certain triphenylcarbinol dyes and their leuco-compounds: Immunity and hypersensitiveness toward *Vaccinia variolae*, M. COPLAND (*Jour. Path. and Bact., 25 (1922), No. 2, pp. 173-190*).—A method is described for the preparation of bacteria-free calf lymph in from 5 to 15 days by adding to the finely divided mixture of pulp, glycerin, phenol, and normal salt solution, a dyestuff of the triphenylcarbinol series, either malachite green or brilliant green. When the bacteria in the lymph have been destroyed, as determined by aerobic and anaerobic cultivation tests, the dyestuff is converted into the colorless leuco-compound by treatment with sodium hydrosulphite. This treatment checks the bactericidal and vaccini-cidal properties of the dye, but in the event of accidental bacterial contamination of the lymph the bactericidal properties can be restored by shaking the contaminated lymph in the air. The method, the technique of which is described in detail, is thought to be capable of application to the isolation and study of other viruses.

A report is also given of an investigation of the possibilities of subcutaneous injection in place of skin scarification in vaccination against smallpox. While

offering certain advantages, particularly in the gain of time in the onset of reaction in the case of persons revaccinated, the method of subcutaneous injection is considered to require more extended observations before its general validity can be claimed.

Virulence of the organism as a factor in the efficacy of prophylactic vaccines, W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 9 (1922), No. 4, pp. 730-735).—From experiments conducted on pigeons using virulent and avirulent strains of fowl cholera bacilli as antigens, the conclusion is drawn that the prophylactic administration of an avirulent organism affords protection against infection by the organism in its virulent condition, and that the response to inoculation of an avirulent strain in the form of the agglutinating power of the serum is the same as for a virulent strain.

Immunization or response of immunized animals to a small dose of antigen administered at a long interval after first immunization, W. F. HARVEY (*Indian Jour. Med. Research*, 9 (1922), No. 4, pp. 740-746).—Five pigeons were inoculated intravenously with the equivalent in suspension of 1 mg. of dried bacterial typhoid antigen, and the serum was examined first at 10-day and then at 30-day intervals throughout a period of 12 months for the agglutination titer. The pigeons then received intravenously a series of doses of the antigen ranging from 1 mg. to 0.01 mg. following which the serums were tested at 3-day intervals for the appearance of agglutinins and for the agglutinin titer. There served as controls 5 pigeons which had received no antigen at all and 5 which had not received any antigen previously, but which received the same doses as the immunized pigeons.

The agglutinin titer of the inoculated pigeons showed a diminution month by month after the inoculation which was most marked between the tenth and twentieth day and very slow thereafter. The intravenous injection of a dose of antigen one tenth to one-twentieth smaller than the original doses caused an agglutinin response in the pigeons inoculated 12 months previously significantly greater than in uninoculated pigeons receiving the same dose. While the number of animals used in the investigation was too small to permit definite conclusions, the possibility is suggested that a very small dose of antigen would be sufficient to immunize an individual after he had once been immunized.

On the immunizing properties of allied organisms and nonspecific organisms, W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 9 (1922), No. 4, pp. 736-739).—A study of the relative immunizing properties against a specific organism of the same organism, an allied or group organism, and a nonrelated organism was conducted on pigeons, using *Bacillus avisepticus*, *B. cuniculisepticus*, and *B. coli*, respectively, for immunization against *B. avisepticus*. Protection of the highest order was secured by the specific organism, but the allied organism showed no greater protective action than the non-related organism. Of 15 birds in each set, the entire number were protected by the specific organism and 5 each by the related and nonspecific organisms.

Differentiation of hemolytic streptococci from human and bovine sources by the hydrolysis of sodium hippurate, S. H. AYERS and P. RUPP (*Jour. Infect. Diseases*, 30 (1922), No. 4, pp. 388-399).—"It has been shown that hippuric acid is hydrolyzed by the 44 hemolytic streptococci from the udders of cows, but not by the 33 hemolytic streptococci of human origin which are in our collection of cultures. As much as 1 per cent of hippurate may be split into benzoic acid and glycolic acid. The hydrolysis is not affected by the hydrogen-ion concentration of the medium, at least under the experimental conditions of our work. The composition of the medium does not appear to affect the

hydrolysis, provided it is suitable for the growth of the streptococci. Simple tests have been devised for the detection of the hydrolysis routine work.

"The hydrolysis of sodium hippurate seems to separate the hemolytic beta streptococci of the bovine udder from those of human origin, but should be used at present only with beta hemolytic types. It is hoped this reaction will be equally valuable after large numbers of cultures have been examined. Particular attention is called to the fact that the usefulness of the hydrolysis of sodium hippurate is discussed only in its relation to the beta hemolytic streptococci of human and bovine origin. Our studies have shown that the ability of streptococci to split sodium hippurate is not limited to the hemolytic types. Some of the alpha types from the udder of the cow do not produce the hydrolysis, while, on the other hand, the hydrolyzing property is common among the lactic type of streptococci. The test must not be applied indiscriminately, therefore, to all groups of streptococci."

[**Life history of the microorganism of anthrax**], H. MORRIS (*Louisiana Stas. Rpt.*, 1921, pp. 18, 19).—The author's investigations of the anthrax bacillus have shown that it will remain virulent for guinea pigs for a period of 12 years while suspended in lake water, in milk for a period of 10 years, and in feces of the dog for a period of 9 years. It was found that a dried blood smear is not suitable material for making cultures or animal inoculations, as the vegetative form of anthrax is soon killed by drying.

The clinical applicability of the lipid fixation reaction of Meinicke, L. RICHTERS (*Ztschr. Veterinärk.*, 34 (1922), No. 4, pp. 112-119).—The author concludes, as the result of an extensive comparison of the complement fixation test and the lipid fixation test of Meinicke (E. S. R., 43, p. 277) that the latter gives doubtful and nonspecific reactions and should not be used for the diagnosis of glanders.

Pneuropneumonia inoculation with lymph and culture virus, J. WALKER (*Kenya Colony Dept. Agr. Ann. Rpt.* 1919-20, pp. 60-68) — Essentially noted from another source (E. S. R., 47, p. 81).

Some observations in connection with rinderpest immunization, J. WALKER (*Kenya Colony Dept. Agr. Ann. Rpt.* 1919-20, pp. 47-59) — Essentially noted from another source (E. S. R., 47, p. 183).

A study of *Trypanosoma americanum*, R. W. GLASER (*Jour. Parasitol.*, 8 (1922), No. 3, pp. 136-144, pls. 4).—The author was successful in growing *T. americanum* in horse blood and N. N. N. medium, as well as in cow-blood medium.

The occurrence of tubercle bacilli in macroscopically unchanged cows' udders and in the blood of tubercular animals, K. TITZE and H. LINDNER (*Ztschr. Fleisch u. Milchhyg.*, 32 (1922), No. 9, pp. 109-113).—In observations on several tubercular cows and calves it was found that blood from tubercular animals injected into guinea pigs produced tuberculosis in the guinea pigs in a very few cases, indicating that the bacilli were not free in the blood. Further observations tended to show that the bacilli were found rather frequently in apparently normal udders of tubercular animals.

The Pennsylvania plan for the control of bovine tuberculosis and the relative value of the different methods of applying tuberculin, S. E. BRUNER (*Cornell Vet.*, 12 (1922), No. 2, pp. 160-174).—The author discusses certain points which have been found helpful in bovine tuberculosis control work in Pennsylvania, outlines the policy in that State for the control of the disease, and presents the results of an extensive investigation of the relative merits of the subcutaneous and intradermal tuberculin tests. From the results ob-

tained in this study, the conclusion is drawn that both tests are of equal value as initial tests, but that based on autopsy findings the subcutaneous is the superior.

Cultivation of *Bacterium tularensis* on three additional mediums new to this organism, E. FRANCIS (*Pub. Health Rpts.* [U. S.], 37 (1922), No. 17, pp. 987-989) —“Cultures of *B. tularensis* of human and ground-squirrel origin which have been carried one year on artificial mediums other than coagulated egg yolk grow well on (1) cystin agar, (2) plain agar plus a piece of fresh sterile rabbit spleen, and (3) Loeffler's blood serum coagulated at 70° C. The same cultures fail to show growth on plain agar and in fermentation tubes containing beef infusion broth.

“Cultures in the fifth generation on these special mediums caused acute death with typical lesions of tularaemia in guinea pigs from which *B. tularensis* was cultured on the same mediums. These latter cultures in the fifth generation caused acute death in guinea pigs with typical lesions of tularaemia.”

Staggers or shivers in live stock, S. DODD and M. HENRY (*Jour. Compar. Path. and Ther.*, 35 (1922), pt. 1, pp. 41-61) —The authors find that this enzootic affection of horses, cattle, and sheep, occurring in certain parts of New South Wales, is apparently an intoxication resulting from the ingestion of certain plants. Two plants, namely, *Malva parviflora* and *Lamium amplexicaule*, have been proved to be capable of producing the condition experimentally. The main symptoms appear to result from the action of a toxic substance on the central nervous system, the nature of which has not been determined. Although the disease is common in adult sheep under natural circumstances, in a number of experiments only lambs showed symptoms, the ewes remaining apparently unaffected.

A contribution to the morphology of the blood of normal and leukemic bovines, P. J. DU TOIT (*Arch. Wiss. u. Prakt. Tierheilk.*, 43 (1917), No. 2-3, pp. 145-202, pls. 2) —The first part of this paper consists of a review of the literature in connection with a bibliography of five pages. This is followed by a report of studies of the leucocytes of normal cattle and of those affected with leukemia, together with transmission and control experiments.

The total number of leucocytes in healthy growing cattle varies from 5,000 to 10,000 with an average of 8,000 per cubic millimeter of blood, and consists of lymphocytes 49, mononuclears 3.7, neutrophils (polymorphonuclears) 38.8, eosinophils 8, and mast cells 0.5 per cent. As compared with human blood, that of cattle shows a higher percentage of lymphocytes and a lower percentage of neutrophils. The percentage of eosinophils present is, as a rule, very high in cattle. In calves and young cattle the leucocyte content reaches 12,000 to 15,000, and contains relatively more lymphocytes (up to 80 per cent) than the blood of mature cattle.

Immunization of cattle against contagious abortion, C. H. SCHULTZ (*Vet. Med.*, 17 (1922), No. 6, pp. 277, 278, 288) —This is an abstract of a paper by Gminder previously noted from the original source (*E. S. R.*, 45, p. 784).

On the cure of malignant catarrhal fever of cattle by use of Bayer 205, ELLINGER (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 41, pp. 483, 484). —The commercial preparation Bayer 205 has been found to give the best results of any medicinal preparation in the treatment of this disease, as it has in the treatment of dourine.

The cattle tick and other ticks in New Zealand, D. MILLER (*New Zeal. Jour. Agr.*, 24 (1922), No. 1, pp. 1-7, figs. 6). —This is a brief account of the ticks

found in New Zealand, particularly the New Zealand cattle tick (*Haemaphysalis bispinosa* Neum.), which occurs in the northern part of the North Island.

On Ascaris vitulorum Goeze, C. L. BOULENGER (*Parasitology*, 14 (1922), No. 1, pp. 87-92, figs. 3).—An account of this ascarid parasite of cattle, based solely on material from the Punjab and Northern Rhodesia.

Bacillus botulinus and botulism, V. A. MOORE (*Cornell Vet.*, 12 (1922), No. 2, pp. 83-87).—This is essentially a criticism of the conclusions drawn by Graham regarding the possible presence of *B. botulinus* toxin in antihog-cholera serum as being the cause of breaks following hog cholera immunization (E. S. R., 46, p. 378) "When one takes into account the life requirements of *B. botulinus* and its distribution in nature, the conclusion seems to be clear that the so-called breaks in hog cholera immunization are due generally to causes other than *B. botulinus*."

The erythrocytes in infectious diseases of the horse, H. LOCHTKEMPER (*Monatsh. Prakt. Tierheilk.*, 31 (1920), No. 3-4, pp. 159-181).—According to the author's investigations, findings of 5,000,000 to 6,000,000 erythrocytes per cubic millimeter indicate a slight anemia, 4,000,000 a moderate anemia, and 2,000,000 to 3,000,000 a very severe anemia. Glanders particularly runs the course of a severe secondary anemia. A bibliography of 24 titles is included.

Post-mortem examination of poultry, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, pp. 12-15, figs. 5).—In his discussions of methods the author calls attention to the importance of determining the nature of the affection causing the loss and thus being able to combat it intelligently and prevent unnecessary loss.

Practical suggestions for raising turkeys, E. E. TYZZER and M. FABYAN (*Mass. Dept. Agr., Dept. Bul.* 15 (1922), 2. ed., rev., pp. 31, pls. 2, figs. 4).—In this bulletin the authors discuss the nature of blackhead, the causative agent of which they find to be not a true ameba but a protozoan of another type, namely, *Histomonas melcagridis*. The transmission of blackhead, including a discussion of intestinal worms as a factor in transmission; a report of the results obtained in raising turkeys at the laboratory; and field experiments at the Saltonstall farm are included. The last seven pages are devoted to the presentation of practical suggestions.

RURAL ENGINEERING.

Irrigation in northern Colorado, R. G. HEMPHILL (*U. S. Dept. Agr. Bul.* 1026 (1922), pp. 85, pls. 24, figs. 16).—The results of an irrigation investigation carried on for a number of years in the valley of the Cache la Poudre River in northern Colorado by the U. S. Department of Agriculture, in cooperation with the Colorado Experiment Station, are presented in this report.

The characteristics of the climate of the valley are a light rainfall, a wide range in daily and seasonal temperature, low relative humidity, moderately high wind movement, and a comparatively low rate of evaporation.

The prevailing type of soil is a light sandy loam, which is generally well drained. The average depth of water applied for an irrigation is close to 0.75 ft., but the average is raised somewhat by the heavier irrigations when a direct flow of water is available in order to reduce the later requirements of stored water.

The water supply of the valley averages 464,000 acre-feet, which includes 340,000 acre-feet of normal run-off in the river and its tributaries, 35,000 acre-

feet of foreign water, 5,000 acre-feet pumped from wells, and available seepage return to the amount of 84,000 acre-feet. Practically the whole supply is said to be used. The total seepage return in the valley is 137,000 acre-feet. The topography is such that a large proportion of this seepage return is available for use. Drainage is not a serious problem in the valley. In the aggregate, canal capacities exceed their appropriations by 10 per cent. Almost without exception distribution from the river is made in accordance with decreed priorities.

The duty of water for the river as a whole is 1.67 acre-feet per acre. The consumptive duty for the valley is estimated at not to exceed 1.25 acre-feet per acre. The area actually irrigated in the valley proper in 1917 was 225,700 acres. The majority of the canals of the valley are cooperative enterprises. The absorption loss in the canals of the valley between the head gate and the farm lateral is estimated to average 10 per cent of the supply.

Furrow irrigation and flooding from field laterals are the only methods of irrigation practiced. Best results are said to be obtained by a fast irrigation to a depth of from 0.4 to 0.6 ft. The run-off from the lower end of the field is estimated to average 6 per cent of the amount applied. The average number of irrigations applied on the fields under investigation ranged from 1.21 for wheat to 3.79 for potatoes. The average duty in acre-feet per acre, measured at the head of the farm lateral, was found to be 2.57 for alfalfa, 1.04 for wheat, 1.35 for oats, 1.19 for barley, 1.86 for sugar beets, 2.2 for potatoes, and 0.69 for beans.

Considerable information regarding structural features is also included.

Effect of elevation upon run-off from catchment areas, A. HAZEN (*Engin. News-Rec.*, 89 (1922), No. 2, pp. 62-64, figs. 4).—A study is presented of run-off data for northeastern streams to aid in estimating the run-off from certain areas in New Jersey. The analysis indicates an average relation between elevation and run-off of 0.0064 in. of run-off per annum for each foot of difference in average elevation. This figure was taken provisionally as a basis for adjustment of all the data used in this study, and the figures so corrected for both water surface and elevation are presented in tabular and graphic form.

Tractor motor lubrication and kerosene fuel (*Wisconsin Sta. Bul.* 339 (1922), p. 69).—Experiments by F. W. Duffee to determine the lasting qualities of lubricating oil when burning kerosene showed that an oil with an initial viscosity of 540 seconds at 100° F. deteriorated at the end of 15 hours running so that the viscosity had dropped to an average of 200 seconds. The greatest drop in viscosity occurred during the first 2.5 hours.

It was found important to warm up the motor well before shifting from gasoline to kerosene. No material advantage was obtained by burning high test gasoline for a half hour at the beginning over merely warming up with common low test gasoline. This experiment is considered to demonstrate the importance of changing the oil frequently when burning kerosene.

New method proposed of arriving at heat losses due to wind, H. M. HART (*Heating and Ventilating Mag.*, 19 (1922), No. 6, pp. 31, 32, fig. 1).—A new method of arriving at heat losses due to wind for use in the designing of buildings is briefly suggested, which is based on U. S. D. A. Weather Bureau records of wind velocities and directions during cold spells. Tabular and graphic data are included.

The preservation of shingles (*Pennsylvania Sta. Bul.* 170 (1922), p. 26).—It is stated that a 13-year comparative service test of redwood, western red cedar, chestnut, treated chestnut, southern yellow pine, and pitch pine shingles has indicated no difference in the durability of the shingles. The creosoted

shingles of pitch pine and loblolly pine have remained in as good condition, so far as durability is concerned, as redwood or western red cedar. Considerable difference in the physical properties of the different materials, however, is evident. The pitch pine shingles were found to be badly warped and curled up at the edges and showed light streaks from inside the barn, causing some leakage.

Silos and silage, L. STEVENSON (*Ontario Dept. Agr. Bul. 287 (1922), pp. 32, figs. 21*).—This bulletin gives practical information on the location, planning, construction, and filling of silos with particular reference to conditions in the Province of Ontario, Canada. Special attention is given to stave, wooden hoop, pit, cement block, all metal, metal lath, vitrified tile, monolithic concrete, and concrete stave silos.

Root and storage cellars, A. V. NICHOLSON (*Canada Dept. Agr. Pamphlet 10, n. ser. (1922), pp. 11, figs. 4*).—Practical information, drawings, and bills of materials for root and storage cellars adapted to Canadian conditions are presented in this pamphlet.

Reinforced concrete tanks (*Queensland Agr. Jour., 17 (1922), No. 6, pp. 267-270, figs. 2*).—Drawings and specifications for the construction of reinforced concrete water tanks, above and below ground, are presented.

A farm well (*Jour. Dept. Agr. Victoria, 18 (1920), No. 10, pp. 607-610, figs. 4*).—Drawings and specifications for the construction of a deep farm well are presented.

Successful sewage disposal systems for farm and rural homes and schools, F. R. KING (*Dom. Engin., 97 (1921), Nos. 12, pp. 533-536, figs. 8; 13, pp. 575-579, figs. 8; 14, pp. 627, 628*).—In this article information is presented and sewage disposal systems are described and illustrated, as the results of eight years of study of the subject by the Wisconsin State Board of Health. Some of the more important conclusions arrived at from this study are as follows:

The cesspool is an obsolete and unsatisfactory method of sewage disposal, and its construction is contrary to sanitary requirements. No matter what means of final disposal of the effluent are adopted, a septic tank should be built in every case for the treatment of sewage where there is no connection to a public sewer. A septic tank will remove the greater part of the solids from the sewage and so lessen its offensiveness. Those solids which remain in the tank will accumulate and should be removed once or twice yearly.

The effluent from a septic tank is as dangerous to health as the raw sewage discharged from the house. If compact clay exists below the surface of the ground and the topsoil shows presence of sand or gravel, or is otherwise porous, a drain tile absorption field should be used for the disposal of the effluent. If the soil is impervious clay throughout, an absorption field is useless, and unless a surface outlet is available, no system can be made to work satisfactorily. Septic tanks and pipe lines may be successfully operated during winter at shallow depths if certain requirements relating to covering are observed.

A sewage effluent disposal unit, whether surface or underground, should be removed as far as practicable from the house and from any source of domestic water supply. The water-tight treatment tank itself may be located in close proximity to the building. It is impracticable to specify the minimum distance from an underground water supply at which it is safe to discharge sewage on or into the soil. Treating of sewage and disposal of treated effluent from a septic tank are two distinct and separate problems which must not be confused.

The action of certain bacteria on the nitrogenous material of sewage, E. G. BIRGE (*Wis. Univ. Studies Sci. No. 2 (1921), pp. 139-150*).—Preliminary studies are reported the purpose of which was to determine the chemical action of certain individual species of bacteria on sewage in pure cultures, singly or mixed. Those selected were *Bacillus coli*, *B. cloacae*, *B. pyocyaneus*, *B. vulgaris*, *B. mesentericus ruber*, and *B. subtilis*. They were selected because they represent aerobic types which are found frequently or constantly in sewage. The effects of these bacteria were studied in fresh sewage, filtered and sterilized by heat at 120° C. (15 lbs. pressure) for 45 minutes. They were also studied under aerobic and anaerobic conditions in pure and in mixed cultures. Particular attention was paid to the changes in free ammonia, organic nitrogen, nitrites, and nitrates.

Bacteriologically it was shown that *B. coli* was completely overgrown under anaerobic conditions in the 24-hour period. Under aerobic conditions it was able to overgrow *B. pyocyaneus*, but was overgrown by the rest of the bacteria studied. When grown in pure cultures, with the exception of *B. proteus*, the bacteria gave more constant results under aerobic than anaerobic conditions. *B. subtilis* showed a marked ammonifying power throughout the work under aerobic conditions. Under anaerobic conditions it regularly decreased the free ammonia and organic nitrogen content, increasing the nitrites and nitrates, especially the latter. *B. coli* and *B. cloacae* had a decided reducing action on both the nitrites and nitrates. Under some conditions, as yet undetermined, they reduced the free ammonia content also. *B. proteus* had a considerable ammonifying power under anaerobic conditions. This was very slight under aerobic conditions, and was more constant at room temperature than at 37.5° C. The action of *B. pyocyaneus* and *B. mesentericus ruber* was irregular under both aerobic and anaerobic conditions.

The experiments with mixed cultures showed that the chemical changes followed very closely those of the predominant bacteria in pure culture. Those experiments which did not follow this rule, and in which there was a decided predominance of one microorganism, showed that the bacteria had become predominant too late in the incubation period to effect a chemical change. *B. coli* and *B. cloacae*, and *B. coli* and *B. proteus* gave more constant results when grown in mixed than in pure cultures. These were the only instances of an apparently true symbiotic relationship. The results of the experiments in which more than two bacteria were grown in mixed culture showed that the incubation period, 24 hours, was too short to allow any one microorganism of any group of bacteria to establish itself chemically.

It is concluded that it is possible to predict the changes in the chemical composition of sewage if a group or species of bacteria is predominant, although the results so far are not considered sufficient to justify an attempt to control the bacterial flora of the septic tank.

BURAL ECONOMICS AND SOCIOLOGY.

Farm organization studies on irrigated farms in the Billings region of Montana, E. L. CURRIER and D. C. WOOD (*Montana Sta. Bul. 144 (1921), pp. 77*).—Records were secured by the survey method from 375 farms in an irrigated area along the Yellowstone River adjacent to Billings and in Clark's Fork Valley. The studies were made during the summer of 1915 and are concerned with the farm year ended March 31, 1915. Field work was undertaken by the station and the U. S. Department of Agriculture, cooperating.

Farms included in the study had an average investment of \$14,904. Total receipts were \$2,936, being sufficient to pay total expenses of \$1,283, plus 6 per cent interest on the capital invested, and leave an average labor income of \$759.

Farms with yields over one-fifth better than the average had a labor income of \$1,608, while those with yields one-fourth poorer than the average or less had a labor income of \$25. Farms with receipts of less than \$30 per productive animal unit had an average labor income of \$574, while those with such receipts of over \$110 had an average labor income of \$1,861. A relatively large amount of productive live stock gave a relatively high labor income. By-products from the sugar-beet crop, an abundance of pasture and roughage furnished in the cropping system, and the large amount of range land contributed favorably to live-stock production. Crop yields were found to be larger on the more heavily stocked farms. The relatively large farms had the highest labor incomes.

Two distinct types of intensive farming were found on 151 farms of less than 60 crop acres. The sugar-beet crop formed the basis of one type and dairying or raising breeding stock of high quality that of the other. Farms without beets had an average labor income of \$128 and an adjusted labor income of 34. This income is calculated by grouping farms according to size, using the average labor income in each group as 100 per cent and expressing the labor income of each farm in terms of this. Farms with over half of their crop acreage in beets had an average labor income of \$741 and an adjusted labor income of 210. Those with a crop index of 121 and over had a labor income of \$755 and an adjusted labor income of 196, while those with a crop index of 70 and less had a labor income of \$23 and an adjusted labor income of 5. It is deemed desirable that the small farms include an important acreage of some cash crop. Small farms with crop and stock receipts of over \$50 per crop acre had a labor income of \$903. Those with such receipts amounting to less than \$20 made a minus labor income of \$51. The average labor income on beet farms during the survey year was \$976. On farms not growing beets it was \$364. The beet farmer put 178.3 days of productive work on his farm during the year, receiving \$5.47 per day, while the nonbeet farmer put in 131.7 days and received \$2.76 per day.

Of the 375 farms included in this study, 98 were operated by renters and 79 by those who rent a part of their land. Renters with an average capital of only \$695 received a larger labor income than that of owners having an average investment of \$12,451. Renters with an average capital of \$6,756 made an average labor income of \$2,908, while owners with capital averaging over \$40,000 had a labor income of only \$849.

Tenants on the average were operating a much larger farm business and securing 27 more days of productive work per man annually than were owner operators.

Farm management studies—lessons from irrigated farms in the Billings region. E. L. CURRIER (*Montana Sta. Circ. 101* (1921), pp. 36, figs. 28).—This is a popular edition of the above bulletin. Data are presented graphically in 28 figures.

Investigations with regard to profits from Swiss agriculture in the crop years 1918–19 and 1919–20. E. LAUR ET AL. (*Landw. Jahrb. Schweiz*, 35 (1921), No. 1, pp. 91–173).—This report has been previously noted (E. S. R., 46, p. 591) in the French edition.

Record form for berry field labor operations. J. L. STAHL (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, p. 16, fig. 1).—A record form, listing the separate field labor operations with columns for recording the num-

ber of man, horse, and automobile hours; the rate per hour; the number of crates picked; and the date of the various operations, is suggested here.

Cooperative consolidation of holdings in the Punjab, H. CALVERT (*Agr. Jour. India*, 17 (1922), No. 1, pp. 7-17).—The evils of successive partition of holdings in the Punjab have led to the suggestion of a system whereby owners would voluntarily agree to the desirability of consolidation, and to abide by a plan approved unanimously or by two-thirds of the owners united in a cooperative society to give up possession of their own lands and accept those allotted to them in cultivating possession for four years.

There had been registered 69 societies for the consolidation of holdings up to the end of September, 1921, with the gross result that 1,653 owners, who formerly possessed 8,100 acres in 10,906 fields, now have this land consolidated into 2,071 fields. The average size of a field before consolidation was three-fourths of an acre; now it is four acres. In nearly all cases the exchange of possession has been made permanent from the start.

A tabulated statement is given showing the progress of this consolidation in 1920-21.

The Federal farm loan system, I. WRIGHT (*Illinois Sta. Circ.* 259 (1922), pp. 20).—This is an outline of the organization and methods of operation of the system, including the joint-stock land banks. A directory of National Federal farm loan associations in Illinois and of joint-stock land banks in the United States is given.

Agricultural manual of New York State, compiled by E. VAN WAGNER (*N. Y. State Dept. Farms and Markets, Div. Agr. Bul.* 133 [1921], pp. 857, pls. 182, figs. 71).—A description of the agriculture of the State is given by counties, including maps, historical data, facts relating to production and marketing, and general items.

The evolution of Belgian agriculture, M. DEFOURNY (*Jour. Soc. Natl. Agr. Belg.*, 4 (1922), No. 5, pp. 33, 34).—The author explains the development of the live stock industry in Belgium at the expense of grain acreage and yields per acre as due to the opening up of wheat lands in the United States. Recent high prices of grain are said not to have influenced any definite tendency to return to grain production, perhaps because the numbers of live stock were depleted during the war so that it has been difficult to maintain the fertility of the land. The possibility that in the future the country must become more self-sufficing is suggested.

Review of the agricultural development of the Dutch East Indies, M. MÜLLER (*Fühling's Landw. Ztg.*, 69 (1920), No. 19-20, pp. 386-393).—A brief history of the agricultural development of this region, customs of landholding, and labor problems is given.

Brief summaries of the effect of recent legislation.—Sessions, 1919-1921 (*London: Central Landowners' Assoc.*, [1920], pp. 24; 1921, pp. 55; 1922, pp. 15).—In these memoranda there have been prepared annual summaries of legislation affecting British landowners.

Official grades for the standardization of Idaho farm products, 1922 (*Boise: Idaho Dept. Agr.*, 1922, pp. 67).—This defines the latest official grades for specific agricultural products of this State.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 1 (1922), Nos. 21, pp. 441-464, figs. 6; 22, pp. 465-480, figs. 2; 23, pp. 481-496, figs. 3; 24, pp. 497-520, figs. 3; 25, pp. 521-544, figs. 3).—These numbers offer notes on weather conditions, with temperature and precipitation charts, for weeks ended May 23 and 30 and June 6, 13, and 20. The usual tabulated weekly reports on prices and receipts in the market of important agricultural

commodities are given, together with special articles on local or outstanding market situations and foreign markets. No. 24 contains the June crop reports, including tabulated summaries of crop conditions, with comparisons, and the usual current reports on estimated farm value of important products and averages of prices received by producers. Special articles in Nos. 21 and 22 review farm prices in general and the index numbers of specified farm products in the years 1919 to 1921, inclusive. No. 23 contains a special statistical article on milk production in 1921, with comparisons, and No. 25 the results of a special survey on pig production.

Crop report for Michigan, V. H. CHURCH (*Lansing: Mich. Dept. Agr., 1922, pp. 32*).—This report is issued by the Bureau of Markets and Crop Estimates, U. S. D. A., in cooperation with the Michigan Department of Agriculture, and is based on figures submitted by voluntary crop reporters, answers to special inquiries, and other sources of information, constituting an annual summary for 1921, with agricultural statistics for the period 1866 to 1921, inclusive.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul., 9 (1922), Nos. 52, pp. 6; 53, pp. 10, nos. 2*).—In the first of these two numbers the benefits to be derived from selling wool cooperatively are briefly set forth, and in the second a detailed financial statement on a carload of hogs handled cooperatively is given. The usual partial lists of products which farmers have for sale are included.

Report on the grain trade of Canada, 1921, W. DOUGAN (*Canada Bur. Statis., Rpt. Grain Trade Canada, 1921, pp. 153, pl. 1, figs. 5*).—This volume continues statistics previously noted (*E. S. R., 46, p. 496*). Tables have been added in this report showing the origin of grain at country elevators by railway subdivisions and loadings over platforms. Data showing the rail movement of grain to the head of the lakes and the all-rail movement to the East have been made more comprehensive. Further tables have been included showing the export movement of wheat and wheat flour by shipping routes and by both the United States and Canadian Atlantic ports.

[Agricultural statistics of Peru, 1920] (*Peru Statis. Abs., 1920, pp. 82-90*).—These agricultural statistics continue the series of reports (*E. S. R., 45, p. 596*).

[Agricultural statistics for Spain, 1920] (*An. Estadís. España, 7 (1920), pp. 42-69*).—Summaries for periods of years and estimates of the production of the principal crops by Provinces in Spain in 1920, also statistics of forest and of live stock production, are set forth in these pages.

[Agricultural statistics of Siam] (*Siam Statis. Yearbook, 6 (1921), pp. 245-263*).—Statistical tables in these pages set forth the total numbers of title deeds issued and filed on March 31, 1917 to 1921; mortgages and mortgage redemptions registered, the area, and production of certain crops, 1916-17 to 1920-21; and the number of coconut trees and of live stock, 1918-19 to 1920-21, by subdivisions.

AGRICULTURAL EDUCATION.

[Biennial survey of agricultural and home economics education, 1916-1918] (*U. S. Bur. Ed. Bul. 88 (1919), pp. 756, figs. 5*).—The following chapters appear in this bulletin, which constitutes volume 1 of a report of the biennial survey of education, 1916-1918, issued by the U. S. Bureau of Education.

Rural education, H. W. Foght (pp. 159-183).—This is a survey of progress in recent years in rural school organization and supervision. Three types of school organization, namely, the district, town (township), and county, are

briefly noted, and it is pointed out that there is a prevailing tendency in many States toward the county unit system. At the time of making this report 19 States had organized wholly or in part on this basis. The author points out the need of legislation bringing about State, county, and local taxation for the improvement of rural schools. He notes increases in teachers' salaries in the progress of the movement to establish all-year schools, consolidated schools, and rural high schools. In connection with the report on vocational education and the Smith-Hughes Act, a discussion of the Massachusetts plan, prepared by R. W. Stimson, and one describing the Pennsylvania plan, prepared by N. C. Schaeffer, are included. Returns from a study made by the rural school division of the Bureau of Education are noted in a preliminary way. It appears that out of 1,150 counties in 48 States a shortage of 10,456 rural teachers and 2,004 other teachers is reported, California being the only State reporting no shortage. A number of agencies for the advancement of rural education and life are noted.

Agricultural education, C. H. Lane (pp. 297-334).—The circumstances of its passage and the educational policy expressed by the Smith-Hughes Act, its provisions, and the cooperation by the several States are reviewed. Brief abstracts are given of papers on agricultural education at scientific meetings in 1916 and 1917. Notes are also presented on agricultural education in Africa, Great Britain, Canada, China, Latin America, and the Philippine Islands. The educational work of the U. S. Department of Agriculture and the agricultural colleges is summarized, and the program of the Graduate School of Agriculture, July 3-28, 1916, is briefly discussed.

Home economics, H. W. Calvm and C. A. Lyford (pp. 355-390).—This report covers the effects of the war upon courses of study and methods of teaching home economics in the public schools, the development of State and county supervision, and the organization of departments of home economics in State normal schools, colored schools, and colleges and universities. The progress of the movement to maintain practice houses in connection with home economics teaching is noted. Other phases of the subject summarized are the practical application of food courses in the management of lunch rooms and cafeterias and in cooperating with the fraternities, dormitories, and boarding houses; Smith-Lever extension work; nurse's courses and other new developments; surveys; the organization of women interested in home economics education; home economics and national service; and legislation relating to home economics.

Home education, E. C. Lombard (pp. 391-401).—This report sets forth the increasing attention that is being paid to child welfare and home and community problems as exemplified in the programs and publications of and cooperation between various educational agencies. A list of publications on baby and child care and welfare and home making is given.

Some contributions of the New York rural school survey, J. E. BUTTERWORTH (*Jour. Rural Ed.*, 1 (1922), No. 9, pp. 385-396, fig. 1).—Four contributions of the survey previously noted (*E. S. R.*, 47, p. 96) deemed significant to the reorganization of rural school administration are discussed, namely, active control of the survey by a representative group of lay and professional people as a means of securing popular support, the proposal of an administrative organization that looks toward a better distribution of authority in the control of schools, a larger local unit of control based upon natural community boundaries, and a system of finance utilizing fundamental and constant factors in equalizing educational burdens. It is pointed out that the committee of twenty-one appointed for this particular survey was composed of 12 members representing farm organizations and 9 representing educational organizations.

A map is given illustrating a proposed community unit for Delaware County.

An inquiry with regard to practical schools of agriculture for Argentina and proposed legislation, F. BEIRÓ (*Min. Agr. [Argentina], Dir. Gen. Enseñanza Agr. [Pub.]*, No. 95 (1921), pp. 130, pl. 1, figs. 12).—In connection with a bill to establish a system of agricultural education and agricultural development in Argentina, printed here with comment and explanatory notes, some history of earlier attempts of similar legislation has been compiled.

Agricultural instruction [in Dominica], A. KEYS (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 2 (1921), pp. 76-79).—Agricultural training given at the Government Botanic Gardens to sons of peasant proprietors with the object of fitting them for positions as overseers or managers on large estates, also agricultural cadet training based on grammar school education with a science requirement and special lectures and examinations for overseers and other adults, are noted.

[Agricultural education in Algeria in 1920], J. B. ABEL ([*Gouv. Gén. Algérie*], *Exposé Situation Gén. Algérie*, 1920, pp. 436-488).—The institute of agriculture of Algeria (Maison-Carrée), the agricultural school at Philippeville, the experimental garden of Hamma, the experiment station of Ferme-Blanche, and the school of farm household management are reported on.

The Folk High School at Roskilde, E. F. FRAZIER (*South. Workman*, 51 (1922), No. 7, pp. 325-328).—A brief account is given of the history and present activity of this school in Denmark.

Adventures in idealism, K. SABSOVICH (*New York: Author*, 1922, pp. [X]+208, pls. 16).—This is the biography of H. L. Sabsovich from boyhood and education in Russia through his life as leader in the establishment of the agricultural colony at Woodbine, N. J., and organizer of the Baron de Hirsch Agricultural School.

Comparative study of instruction in consolidated and one-room rural schools in New York State, J. C. MORRISON (*Jour. Rural Ed.*, 1 (1922), No. 8, pp. 355-359).—The investigation reported in these pages was part of a nationwide study undertaken by the department of rural education of the National Education Association. It was proposed to give a certain number of standard group tests in school subjects to all pupils of grades 3 to 8 in chosen consolidated schools and in three or more one-room schools of districts adjacent to the consolidated districts.

The difference in amount of achievement between the schools investigated in New York State was relatively small, but there was a distinct and fairly consistent superiority on each of the several tests of the consolidated group over the one-room school. When compared with the amount of gain that should be made from grade to grade, the excess of the consolidated group over the one-room group was most noticeable in language and spelling and least so in arithmetic.

Some considerations to be observed in placing vocational agriculture in high school programs of study, J. L. HYPES (*Jour. Rural Ed.*, 1 (1922), No. 10, pp. 464-471).—The author suggests that agriculture must be regarded socially and economically as a mode of living, as well as a vocation, that requires training in a rural high school, centering in the life of the community, utilizing the home project, and placing its equipment at the service of the younger men and adults who can not attend the regular day school by offering unit courses and part-time work. The teacher of agriculture should be a man of maturity, with practical farm experience and a technical agricultural and professional education equivalent at least to graduation from our best agricultural colleges

and with some professional training in a teachers' college. With regard to the curriculum and the methods, it is said that both should be designed to make proper allowance for the skill and knowledge already possessed by the average farm boy upon entering high school.

The aim of vocational agricultural education should be a highly economical and productive piece of work suited to the general practice of the community. It is thought that vocational guidance and the inculcation through rural education of such ideals and practical knowledge as will bring about the wider use of conveniences and labor-saving devices in rural homes should stabilize farming and eliminate the turnover in the personnel of the farmers.

Practical poultry production, H. M. LAMON and J. W. KINGHORNE (*St. Paul, Minn.: Webb Pub. Co., 1920, pp. 365, pl. 1, figs. 300*).—Certain basic principles and practices of poultry keeping are presented, the chapter arrangement approximating the sequence in events of actual practice and for classroom study.

Report on cooperative extension work in agriculture and home economics, 1920 (*U. S. Dept. Agr., Rpt. Coop. Ext. Work Agr. and Home Econ., 1920, pp. 53*).—A report is made of the organization of and funds available for cooperative extension work in 1920. Summarizing the results, it is indicated that extension workers came in contact with and assisted in the improvement of farm and farm-home practices of 1,200,000 farmers, 400,000 farm women, and 445,000 farm boys and girls. This work was accomplished at a cost considerably less than the estimated increased return to the farmers in the United States in 1920 as a result of the work done in connection with either rodent pest control, improved corn production, or marketing.

Three comparative tables are given, the first showing the number of people reached and the results accomplished as compared with the total number and products of farmers in the United States; the second dealing with the extension activities affecting the farm home; and the third showing the number of members of boys' and girls' clubs enrolled, those completing their work satisfactorily at the end of the year, and results accomplished. It is pointed out that of the 8,000,000 farm boys and girls from 10 to 21 years of age, from 70 to 80 per cent remain on the farm. Since the opportunities for these boys and girls to get vocational training in agriculture and home economics is limited, the immediate as well as the potential and ultimate value of club work is evident. Other tables are included for expenditures and sources of funds.

Four-H clubs in West Virginia, W. H. KENDRICK (*Jour. Rural Ed., 1 (1922), No. 8, pp. 364, 365*).—The distribution of points on 4-H score cards for members of boys' and girls' agricultural clubs is set forth.

MISCELLANEOUS.

The work of the San Antonio Experiment Farm in 1919 and 1920, G. T. RATLIFF (*U. S. Dept. Agr., Dept. Circ. 209 (1922), pp. 39, figs. 5*).—The experimental work at this farm during 1919 and 1920 is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Georgia Station, 1921, H. P. STUCKEY (*Georgia Sta. Rpt. 1921, pp. 26, figs. 6*).—This contains the organization list, a report by the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Louisiana Stations, 1921, W. R. DODSON ET AL. (*Louisiana Stas. Rpt. 1921, pp. 32*).—This contains the organization list, a financial statement regarding the Federal funds for the fiscal year ended June 30, 1921, and the State funds for the fiscal year ended December 31, 1921,

and a report by the director, including brief departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Cranberry Station for 1919 and 1920, H. J. FRANKLIN (*Massachusetts Sta. Bul.* 206 (1921), pp. 149-168).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report from South Mississippi Branch Experiment Station for 1921, E. B. FERRIS and F. B. RICHARDSON (*Mississippi Sta. Bul.* 201 (1922), pp. 20).—The experimental data in this report are for the most part abstracted elsewhere in this issue. A test of eight varieties of tomatoes for wilt resistance is also included.

Report from Holly Springs Branch Experiment Station for 1921, C. T. AMES (*Mississippi Sta. Bul.* 202 (1921), pp. 29, figs. 5).—The experimental work covered in this report is for the most part abstracted elsewhere in this issue.

Report of the New Hampshire Station for 1921, J. C. KENDALL (*New Hampshire Sta. Bul.* 203 (1922), pp. 31, figs. 2).—This contains the organization list, a report on the work of the station, and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of New Mexico Station, 1921, F. GARCIA (*New Mexico Sta. Rpt.* 1921, pp. 48).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Fortieth Annual Report of Ohio Station, 1921, C. G. WILLIAMS (*Ohio Sta. Bul.* 353 (1921), pp. XXX+5, fig. 1).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, and a report of the director summarizing the work and publications of the station during the year. The current experimental work reported is for the most part abstracted elsewhere in this issue.

Two years of research (for the biennium ending June 30, 1921) (*Pennsylvania Sta. Bul.* 170 (1922), pp. 32).—This bulletin discusses briefly the work of the station for the biennium ended June 30, 1921, including financial statements for this period. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Annual Report of South Dakota Station, 1921, J. W. WILSON ET AL. (*South Dakota Sta. Rpt.* 1921, pp. 37).—This contains a report by the director on the organization, work, and publications of the station; a financial statement for the fiscal year ended June 30, 1921; and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

New pages in farming: Annual report of the director for 1920-21, H. L. RUSSELL and F. B. MORRISON (*Wisconsin Sta. Bul.* 339 (1922), pp. 143, figs. 40).—This contains an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1921. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 1, pp. 23, figs. 18).—In addition to articles abstracted elsewhere in this issue, this number contains a brief article entitled *Head Lettuce in Western Washington*, by J. L. Stahl.

Rothamsted Experimental Station: Reminiscences, tales, and anecdotes, 1872-1922, E. GREY (*Harpenden, Herts, Eng.: Author*, [1922], pp. 155, pls. 7, figs. 6).—This account is noted editorially on page 401.

NOTES.

Idaho University and Station.—The new beef cattle barn has been dedicated. It is the largest barn on the university farm, with a floor space 54 by 120 feet. One of the two concrete silos which are to adjoin the barn has also been completed.

R. E. Gongwer, assistant professor of animal husbandry and assistant animal husbandman, has resigned to engage in farming in Indiana. Julius E. Nordby, associate animal husbandman several years ago, has returned to the institution as associate professor of animal husbandry and associate animal husbandman. M. R. Lewis has succeeded T. C. Mead, resigned, as associate professor of agricultural engineering and associate agricultural engineer.

Kansas College and Station.—A 2-story stone cafeteria building has been completed at a cost of about \$125,000. The building has been equipped with modern appliances, and will include a main dining room accommodating from 1,000 to 1,500 persons at the noon hour, as well as several smaller dining rooms, two class-rooms for institutional teaching, and a laboratory for home economics experimental work.

During the last fiscal year the department of agronomy conducted experiments in cooperation with farmers in 67 counties of the State. The total number of these experiments was 299, of which 207 were carried satisfactorily to completion. The experiments included 225 variety tests, 64 fertilizer trials, 7 tests of crop rotation and tillage methods, and 3 miscellaneous tests.

R. I. Throckmorton of the department of agronomy has been granted a year's leave of absence for graduate study. A similar leave of absence has also been granted to L. A. Fitz, head of the department of milling industry, to engage in commercial work, and P. L. Mann, associate professor, will act as head of the department during this time. E. H. Coles has been appointed by the Bureau of Plant Industry, United States Department of Agriculture, as agent in dry land agriculture and assigned to cooperative work at the Garden City Substation. O. C. Bruce, professor of soils in the University of Maryland, has been appointed to the fellowship at the station offered through the National Research Council for the investigation of sulphur as a plant food.

R. L. Hensel, associate professor of pasture management, and H. R. Winchester, associate professor of animal husbandry, have resigned to engage in commercial work. Recent appointments include P. W. Gregory as fellow in animal husbandry, William McKuer as fellow in agronomy, and W. R. Horlacher as instructor in animal husbandry.

Dr. L. Jean Bogert has resigned as head of the department of food economics and nutrition to accept a research position in a Detroit hospital. Dr. Martha Kramer has been appointed associate professor in these subjects. Miss Elizabeth Kirkpatrick, who held a fellowship in home economics last year, has been appointed head of the division of home economics in the Alaska College, which opened its doors this fall.

West Virginia Station and University.—Dr. G. R. Lyman, pathologist in charge of the Plant Disease Survey of the United States Department of Agriculture, has been appointed dean of the college of agriculture, beginning January 1, 1923.

Wyoming University and Station.—A. D. Faville has resigned as dean of the college of agriculture and director of the station and is to spend about a year in study and travel abroad, visiting various experiment stations and similar institutions in Great Britain and on the Continent. J. A. Hill, professor of the textile industry and wool specialist, has been appointed acting dean and director.

Harold S. Willard has been appointed assistant animal husbandman in the station. Lew P. Reeve, county agent for Albany County, has been appointed swine specialist for vocational agriculture work.

Agricultural Education and Research in Canada.—The horticultural work of the Ontario Department of Agriculture is to be consolidated at the Ontario Agricultural College. The consolidation will include the provincial Fruit Branch, the vegetable specialist's work, the Vineland Experimental Station, and the college horticultural department. The staff at Vineland and other places will interchange with the horticultural officials at Guelph and vice versa for lecturing and research purposes, and steps will be taken to coordinate the findings from experiments in various localities.

The Ontario Veterinary College has taken possession of its new buildings located adjoining the Ontario Agricultural College. The new main building is a 3-story gray sandstone structure with a central portion 150 feet long, flanked by wings 130 feet in length. It contains 6 classrooms, each seating over 100 students, 4 laboratories assigned to (1) pharmacy, (2) anatomy, (3) zoology, histology, and pathology, and (4) parasitology and bacteriology, and a clinical amphitheater. A 2-story veterinary hospital has also been erected nearby with accommodations for over 40 animals.

What is believed to be the first attempt in Canada to utilize radio telephoning by a government department for the distribution of information of special interest to farmers took place May 11 and 13. On these dates lectures by the Ontario minister of agriculture and the secretary and supervising director were broadcasted by the Ontario Department of Agriculture over a radius of 150 miles from Toronto.

The Manitoba Agricultural College has established a roll of honor of persons who have distinguished themselves in the development of agriculture in that Province. The first announcements were made at the recent Commencement of the college, one of the recipients being Dr. S. A. Bedford, weeds commissioner of the Province.

A course leading to the degree of bachelor of household science has been instituted at the University of Toronto. This course is primarily for teachers, and the first two years may be taken under the direction of the department of university extension, which makes provision for the work through summer courses. The final two years must be taken in regular attendance at the university.

Steps are being taken by the recently organized Canadian Horticultural Council for organizing a system in Canada for the registration of new varieties of plants. It is expected that a conference on the matter will be arranged during the present year.

A scholarship in horticulture has been established at the University of British Columbia by the provincial Fruit Growers' Association.

C. W. Baxter has resigned as Dominion fruit commissioner to engage in commercial work. F. C. Bailey has been appointed superintendent of the Dominion Experimental Farm at Fredericton, N. B., vice W. W. Hubbard, resigned. Dr. Alex McTaggart, formerly Dominion agriculturist of the New Zealand Department of Agriculture, has been appointed assistant professor

of agronomy in Macdonald College. Dr. G. P. McRostie, associate professor of cereal husbandry at the last-named institution, has been appointed Dominion agrostologist at the Central Experimental Farms, Ottawa. J. S. Dash of the Central Experimental Farms and Dominion Seed Branch has accepted an appointment as professor of agriculture and agronomy in the West Indies Agricultural College at St. Augustine, Trinidad.

American Food Research Institute.—Dr. Wilfred Eldred, for nearly a year engaged in studies of the baking industry, and John L. Simpson, in 1919 liaison officer of the food section of the Supreme Economic Council and chief of the American Relief Administration Commission to Serbia, have been appointed special investigators in the institute. Susan S. Burr, Franklin D. Schurz, and A. G. Silverman have been appointed research assistants, and a corps of five fellows has been selected.

Rowett Research Institute.—The Rowett Institute of Research in Animal Nutrition, located near Aberdeen and under the control of the University of Aberdeen and the North of Scotland Agricultural College, was formally opened by Queen Mary September 12.

The buildings are now practically complete aside from the fitting up of one or two laboratories. The institute is organized into departments of physiology, biochemistry, bacteriology, and pathology, all of which are housed in a main building, and animal husbandry, for which an experimental stock farm with buildings adapted for carrying on feeding experiments has been provided.

The laboratory building is a 2-story and basement granite structure, 156 feet long by 45 feet deep in the central portion and 39 feet deep in the wings, and among other facilities provides for calorimetric work. The experimental farm buildings are nearby and have a floor area of 13,500 square feet.

The total cost is estimated at about £46,000. Of this amount the Development Commission provided £20,000, and a gift of £10,000, together with funds sufficient to purchase the experimental farm, was made by Dr. John Q. Rowett, for whom the institute was named. Various smaller sums have been given by other contributors, and a portion of the funds is still to be raised.

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No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Practical physiological chemistry, J. A. and T. H. MILBOY (*Edinburgh and London: W. Green & Son, Ltd., 1921, 3. ed., pp. IX+449, pls. 3, figs. 20*).—This manual, designed particularly for college students of medicine and biology, consists of modern methods in qualitative and quantitative physiological chemistry.

Research in chemistry as related to medicine, R. H. CHITTENDEN (*Jour Amer. Med. Assoc., 78 (1922), No. 17, pp. 1273-1277*).—In this discussion of the value of chemical research to medicine it is emphasized that "understanding of the normal, natural processes of the body is a necessary prelude to intelligent comprehension of the abnormal or diseased condition." Among the particular subjects discussed are cellular chemistry, vitamins, proteins, and the nature of immunity. In conclusion, a plea is made for greater encouragement of research and for more cooperation in such research.

Catalysis in organic chemistry, P. SABATIER (*La Catalyse en Chimie Organique. Paris and Liege: Ch. Béranger, 1920, 2. ed., rev. and enl., pp. XVI+388, fig. 1*).—This is the third volume of an encyclopedia of chemical science applied to the industrial arts, published under the direction of C. Chabrié.

Distillation principles and processes, edited by S. YOUNG (*London: Macmillan & Co., Ltd., 1922, pp. XIII+509, figs. 210*).—This volume consists of seven sections, the first of which, by the editor, deals with the principles of fractional distillation and is practically a revision of an earlier volume entitled Fractional Distillation. The remaining sections deal with manufacturing processes involving fractional distillation. The subjects and respective authors are as follows; Distillation of Acetone and *n*-Butyl Alcohol on the Manufacturing Scale, by J. Reilly and F. R. Henley; Distillation of Alcohol on the Manufacturing Scale, by F. R. Henley and J. Reilly; Fractional Distillation as Applied in the Petroleum Industry, by J. Kewley; Fractional Distillation in the Coal Tar Industry, by T. H. Butler; The Distillation of Glycerin, by E. Briggs; and The Distillation of Essential Oils, by T. H. Durran.

Colloid chemistry of the proteins, I, W. PAULI, trans. by P. C. L. THORNE (*London: J. and A. Churchill, 1922, pt. 1, pp. XI+140, figs. 27*).—This is a translation of the first part of a monograph on the colloidal chemistry of proteins which has been developed from lectures given by the author at the University of Vienna. The general chemistry of the proteins, the properties of proteins in isoelectric reaction, and salts of proteins with acids and bases are considered in this first part, while the second part will include the rela-

tions of the proteins to neutral salts and to the salts of heavy metals, to colloids, and to ampholytes, the properties of albumin gels, and the physical chemistry of the purest albumin thus far prepared.

Protein of buckwheat, A. KIESEL (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 118 (1922), No. 4-6, pp. 301-303).—The author reports the separation from buckwheat meal by extraction with 0.1 per cent of sodium hydroxid and subsequent precipitation with acetic acid of a protein, which on hydrolysis yielded 0.84 per cent histidin, 6.71 per cent arginin, and 1.60 per cent lysin. A second sample, for which no histidin determination is given, yielded 7.55 per cent arginin and 1.29 per cent lysin.

The proteins of the tomato seed, *Solanum esculentum*, C. O. JOHNS and C. E. F. GERSDORFF (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 439-452).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the proteins of the tomato seed and its press cake, which have previously been reported by Finks and Johns (*E. S. R.*, 46, p. 564) to contain nutritionally adequate proteins. The analysis of five samples of seed and press cake showed an average content of 36.9 per cent of protein ($N \times 6.25$). From tomato seed of high germinating quality, two globulins α - and β - have been isolated and analyzed by the methods employed in previous studies. These globulins were precipitated from their saline solution by 0.3 saturation in the case of the α -globulin and saturation with ammonium sulphate in the case of the β -globulin. The percentages of basic amino acids in the α - and β -globulins were, respectively, as follows: Cystin 1.28 and 1.14 per cent, arginin 13.97 and 10.65 per cent, histidin 1.16 and 3.80 per cent, and lysin 4.89 and 6.35 per cent.

Hydrogenation of corn oil, F. REICHERT and R. A. TIEFLES (*Rev. Facult. Agron. y Vet. Buenos Aires*, 3 (1921), No. 3, pp. 275-277, *fig. 1*).—Attempts at hydrogenating corn oil with platinum and with nickel as catalyzers are reported. With nickel it proved impossible to obtain a solid product, but with platinum at normal pressure and a temperature of from 210 to 230° C. a solid product was obtained melting at 57° and having an iodine number of 21.

Textbook of cellulose chemistry, E. HEUSER (*Lehrbuch der Cellulosechemie*. Berlin: Borntraeger Bros., 1921, pp. VII+188, *figs. 3*).—This volume consists of six chapters dealing, respectively, with the formation of cellulose alcohols, esters, ethers, and oxides, the decomposition of cellulose, and its constitution.

Researches on the presence of manganese in the vegetable kingdom, G. BERTRAND and ROSENBLATT (*Ann. Inst. Pasteur*, 35 (1921), No. 12, pp. 815-819).—Determinations of manganese in various fruits and vegetables by the method previously noted (*E. S. R.*, 26, p. 311) are tabulated, the results being given in milligrams per 100 gm. of fresh material, dried material, and ash. Manganese was found in every part of the plant examined, including the fruit, seeds, leaves, stems, and roots. The authors conclude that manganese is universally present in plants.

The alkalinity of nutrient media measured by the Michaelis indicator method, in its relation to the growth of bacteria, STICKDORN (*Ztschr. Immunitätsf. u. Expt. Ther.*, 1, *Orig.*, 33 (1922), No. 6, pp. 576-580).—From a comparison of the methods of readjusting the reaction of culture media by titration with phenolphthalein or litmus, and by determining the H-ion concentration colorimetrically with *m*-nitrophenol as an indicator, the author concludes that the latter method is to be preferred on account of its greater speed and accuracy.

Bouillon, adjusted with sodium hydroxid following the addition of common salt and sodium phosphate, has proved more stable on subsequent sterilization than media neutralized with sodium carbonate. Tests of the growth of 21

different bacteria in media of varying H-ion concentration have shown that a bouillon of H-ion concentration of $\text{pH}=7.5$ is most suitable for rapid growth.

Leavens: Their action and measurement, C. E. DAVIS and D. J. MAVEETY (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 210-212, figs. 5).—For the purpose of determining the weight ratios of sodium bicarbonate and the different acids and acid salts used in leavening mixtures, the known reactions in the case of tartaric acid and cream of tartar have been checked by direct and electrometric titration and by determinations of the carbon dioxide evolved. In the case of phosphoric acid and primary calcium phosphate, where there was some question as to the end of the reaction, the weight of sodium bicarbonate and carbonate which would react with a given weight of phosphoric acid or primary calcium phosphate was used.

When primary calcium phosphate reacts with sodium carbonate the results obtained depend on the ratio of acid to base and on the time of the reaction. When the theoretical CO_2 was calculated from the acid phosphate used and sodium carbonate was in excess, the CO_2 formed was in amounts corresponding to the reaction $3 \text{Ca}(\text{H}_2\text{PO}_4)_2 + 4 \text{Na}_2\text{CO}_3 \rightarrow 4 \text{CO}_2 + 4 \text{H}_2\text{O} + \text{Ca}_3(\text{PO}_4)_2 + 4 \text{Na}_2\text{HPO}_4$.

When sodium carbonate and primary calcium phosphate were used in molecular proportions and the solid and liquid remaining were tested, it was found that the liquid contained both NaH_2PO_4 and Na_2HPO_4 . The solid consisted of a mixture of $\text{Ca}_3(\text{PO}_4)_2$ and CaHPO_4 , thus showing a complicated equilibrium in the solution and between solid and solution which is disturbed by the action of an excess of Na_2CO_3 , resulting in the precipitation of $\text{Ca}_3(\text{PO}_4)_2$.

The destructive action of cow's milk diastase on various kinds of starch, F. WELZMÜLLER (*Biochem. Ztschr.*, 125 (1921), No. 1-4, pp. 179-186).—The diastase of fresh cow's milk has been found to differ from malt or pancreatic diastase in the temperature optimum. This is about 37°C ., while that of malt and pancreas is 54° , at which temperature the diastatic action of milk is decidedly impaired.

Another difference is in its action on different starches. Bean and pea starches are destroyed by milk diastase almost as readily as potato starch, while cereal starches, considered easily digested, are attacked by milk diastase with greater difficulty.

The determination of small amounts of nitrogen by the Kjeldahl method, J. K. PARNAS and R. WAGNER (*Biochem. Ztschr.*, 125 (1921), No. 5-6, pp. 253-256, figs. 4).—An improved form of apparatus for micro-Kjeldahl determinations is described and illustrated by diagrams and photographs.

Errors caused by nitrates and nitrites in the determination of arsenic by the distillation method, and a means for their prevention, J. J. T. GRAHAM and C. M. SMITH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 207-209).—Data are presented from the Bureau of Chemistry, U. S. D. A., showing that in the presence of nitrates or nitrites the distillation method for arsenic carried out by the Official method, using cuprous chlorid alone or with ferrous sulphate as a reducing agent, gives low results. This is considered to be due to some volatile substance, possibly nitrosyl chlorid, carried over in the distillate, which oxidizes the arsenic trioxid. Tests of various reducing agents have shown that this error may be avoided by the use of hydrazin sulphate as the reducing agent, preferably with sodium bromid.

Directions are given for the modified method, and the results are reported of a comparison of the Official and hydrazin distillation methods in the determination of several samples of calcium arsenate and one of lead arsenate. These figures show that while there is fairly close agreement between results by the two methods when titrations are made immediately after distillation,

the results by the Official method are lower in every case in which the titration is delayed for several hours.

The soil solution, J. E. GREAVES and C. T. HIRST (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 224-226, fig. 1).—An investigation of the most favorable conditions for obtaining clear soil extracts is reported from the Utah Experiment Station and summarized as follows:

"Clear soil extracts may be obtained by adding 2 gm. of lime, ferric sulphate, ferric alum, sodium alum, or potassium alum to the soil-water mixture, by filtering through the Pasteur-Chamberland filter, or by centrifuging. The last three procedures give a clear solution with a minimum loss of salt. Lime, ferric sulphate, and ferric alum cause a considerable loss of nitrates.

"In the determination of chlorids and nitrates nothing is to be gained by agitating the soil and water for more than five minutes, provided the soil is finely divided and the solution vigorously shaken. A longer time of agitation is required to reach equilibrium in a soil solution in which sulphates are to be determined. This time will depend upon the quantity and quality of sulphates present.

"Usually a ratio of one part of soil to five of water is sufficiently wide, but this also will depend upon the quantity and kind of sulphates present.

"Where nitrates are to be determined in the soil solution and alum is used as the flocculent, no other antiseptic is necessary. Where alum is not used and the solutions are to stand for some time, it is well to add 0.5 cc. of chloroform to each sample."

Colorimetric methods for the separate determination of tyrosin, tryptophan, and cystin in proteins, O. FOLIN and J. M. LOONEY (*Jour. Biol. Chem.*, 51 (1922), No. 2, pp. 421-434).—Methods are described for the separation of tyrosin and tryptophan from mixtures of both and the subsequent estimation of each colorimetrically, and for the colorimetric determination of cystin in protein materials.

Tyrosin is separated from tryptophan with 2 per cent mercuric sulphate, the precipitation being quantitative when the acidity lies between 3.5 and 7.5 per cent of sulphuric acid. The mercury is removed from the precipitated tryptophan by solution in sodium cyanid and from the tyrosin solution by the addition of saturated sodium carbonate and subsequent solution in sodium cyanid.

The colorimetric determination of cystin is based upon the use of the Folin uric acid reagent. In the presence of sodium sulphite, cystin gives an intense blue color with this reagent. The publication should be consulted in the original for the details outlined.

Tables are given of the analytical results obtained by these methods, together with corresponding figures taken from the literature representing other methods. The colorimetric tyrosin figures are consistently lower than those obtained by Folin and Denis, but are high in comparison with those obtained by gravimetric methods.

A rapid determination of the acetyl index of fats, A. LEYS (*Jour. Pharm. et Chim.*, 7. ser., 25 (1922), No. 2, pp. 49-56; also in *Ann. Chim. Analyt.*, 2. ser., 4 (1922), No. 4, pp. 110-115).—The method described is similar to that of André (E. S. R., 45, p. 716) in that the index of saponification of the fat is determined before and after acetylation. The formula used for calculating the acetyl value is $A = S' - mS$. S and S' equal, respectively, the saponification number of the fat before and after acetylation, and m equals the amount of fat which will yield 1 gm. of acetylated fat. This factor m is calculated by weighing the acetylated fat obtained from a given amount of the original fat before determining the saponification number.

Microanalytical methods in food investigations, F. WOHACK (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 42 (1921), No. 11, pp. 290-298, fig. 1).—The author discusses the advantages of micro- over macro-quantitative methods of analysis as applied to food materials, and describes micro methods for the determination of vanillin in vanillin sugar and formic acid in food materials.

Studies on flour catalase, T. MERL and J. DAIMER (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 42 (1921), No. 11, pp. 273-290, figs. 5).—Determinations are reported of the catalase activity of wheat, rye, and barley flour under different conditions. The optimum H-ion concentration for the action of the catalase was found to begin at pH=6.2 and to extend to the alkaline side of neutrality. The optimum range varied with the buffer present, phosphate ions bringing the optimum to pH=7. Acetate and lactate ions retarded the speed of reaction, the former to a greater extent than the latter. The optimum temperature for reaction was found to range between 30 and 40° C.

From a large number of baking studies, using flour of a high and low catalase content, it has been concluded that catalase has only a slight effect on baking processes.

Cryoscopy of milk, E. M. BAILEY (*Connecticut State Sta. Bul.* 236 (1922), pp. 251-271).—This is essentially the report of the author as associate referee on dairy products at the annual meeting of the Association of Official Agricultural Chemists held at Washington, D. C., in October, 1921.

With the assistance of various collaborators, data have been secured on the composition and freezing point determinations of 291 samples of milk distributed as follows: Normal individual cows 179, normal herds 61, diseased or otherwise abnormal individual cows 37 and herds 3, and unclassified (requiring further corroboration) 11. The data on freezing-point depression have been classified and discussed as authentic milk from normal individual cows, authentic milk from normal herds, authentic milk from healthy cows and under normal conditions of daily routine and environment, and authentic milk from cows which are diseased or otherwise abnormal physically.

A study of the data thus grouped has led to the following conclusions: There is an appreciable, and may be conspicuous, difference in freezing-point depression between morning and evening milk. This morning-evening variation is greater than that observed between morning samples or evening samples from day to day.

"The minimum freezing point depression of -0.530° C. and maximum of -0.566° for milk from normal individual cows and the minimum of -0.530° and maximum of -0.562° for milk from normal herds is reasonably substantiated by the experience of all collaborators.

"According to the data here reported moderate exercise or moderately delayed milkings are not reflected in the freezing-point depressions of the milk. Long-delayed milkings, 9.5 to 10.5 hours, may or may not be followed by depressions varying from normal. Severe exercise, strain, or fatigue are followed by materially increased depressions.

"The milk from tubercular cows or those otherwise in poor or abnormal physical condition has generally fallen within the limits for normal milk as regards freezing point. The few exceptions noted have been in the direction of decreased depressions.

"Extremely low freezing points observed in certain samples of morning milk suggest a fuller investigation of this point. The study also of the effect of pathological conditions upon the freezing point may well be continued."

Quantitative method for determination of peroxidase in milk, F. E. RICE and T. HANZAWA (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 201,

202).—The method described involves the oxidation of soluble pyrogallol to insoluble purpurogallol by hydrogen peroxid, the extent of oxidation depending upon the amount of peroxidase present.

The milk is first centrifuged to remove the fat. Ten cc. of the skim milk is then transferred to a 100 cc. glass-stoppered bottle, and to this are added 50 cc. of distilled water, 10 cc. of 5 per cent pyrogallol, and 10 cc. of 1 per cent hydrogen peroxid. The bottle is shaken well, filled with a solution prepared by mixing 60 cc. of water with 10 cc. of 1 per cent hydrogen peroxid and 10 cc. of 5 per cent pyrogallol, and is then stoppered tightly and allowed to stand for 7 days at room temperature. The precipitated pyrogallol is filtered on a weighed Gooch and washed, first with the pyrogallol-hydrogen peroxid mixture and finally with distilled water. When the washings cease to give a dark blue color with ferric chlorid solution the filter is dried, washed two or three times with petroleum ether, dried, and weighed. The weight in milligrams of purpurogallin yielded by 10 cc. of milk is called the peroxidase number.

Data are given showing that the peroxidase number varies quite regularly with the concentration of peroxidase. Heating milk below 155° F. for 30 minutes, as in the process of pasteurization, was found to reduce but not entirely to destroy the peroxidase activity. Holding the milk on ice for two days reduced the action slightly and boiling entirely.

The determination of levulose (fructose) in straw, S. H. COLLINS (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 4, pp. 56T, 57T).—Suggestions are given of precautions that must be taken in determining the levulose content of extracts of straw polarimetrically, and data are presented on the maximum, minimum, and average analyses of oat straw from various counties in England.

The penetrability of filter paper, R. C. GRIFFIN and H. C. PARISH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 199, 200, figs. 3).—A new apparatus for testing the penetrability of filter paper is described and illustrated, and comparative penetrability figures for several grades of filter paper are given.

Variations in aliquot fractions of gastric contents, N. KOPELOFF (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 154, 155).—Further evidence of the sources of error in the Rehfuß method of fractional gastric analysis (E. S. R., 46, p. 710) is summarized briefly. On withdrawing the total gastric contents in 10 cc. fractions in rapid succession a wide variation was found in the acidity of the various fractions, showing that a single 10-cc. sample is not a true aliquot of the entire stomach contents. That the total gastric content is not a homogeneous mixture was also indicated by the variations in acidity of fractions of gastric juice drawn simultaneously from different parts of the stomach.

It is considered that "the results obtained by the Rehfuß method may be more validly interpreted if (a) the analysis is repeated until a satisfactory agreement in curves is obtained, (b) the tube is kept at a constant level, (c) aliquot fractions are large, (d) little saliva is swallowed, (e) acidity is measured in terms of hydrogen ions and buffer salts."

A comparison of several clinical quantitative blood sugar methods, W. THALHIMER and H. UPDEGRAFF (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 18, pp. 1383-1388, fig. 1).—This paper reports the results of a comparative study of the Myers and Bailey and the Benedict (E. S. R., 39, p. 112) modifications of the method of blood sugar determination of Lewis and Benedict and the latest modification of the method of Folin and Wu (E. S. R., 42, p. 712), with a few determinations by the original Lewis-Benedict method.

In general the results obtained by the Benedict modification were higher than those obtained by the Myers and Bailey modification, which in turn were

higher than those of the Folin and Wu method. The range of variation in the figures obtained by each method was, however, practically the same.

A series of 24 normal persons, examined during cold weather in March and April by the Benedict modification, gave blood sugar figures ranging with one exception from 0.126 to 0.171 per cent. A series of 19 normal persons, examined in hot weather in July and August, gave results ranging from 0.107 to 0.136 per cent by the Benedict method, from 0.094 to 0.130 per cent by the Myers and Bailey modification, and from 0.075 to 0.115 per cent by the method of Folin and Wu.

The results obtained by the different methods in a series of five experiments on the recovery of glucose added to beef blood showed that the Benedict modification yielded in each case a higher percentage recovery than the other three methods. These yielded results comparable to one another and closer to the theoretical than did the Benedict modification.

The authors conclude that in interpreting the blood sugar findings obtained in any laboratory, it is of greatest importance that the clinician be advised of the method employed in the laboratory in question and of the range of normal figures for this method as actually determined in this laboratory. The choice of a blood sugar method is considered to be a matter of individual preference if these precautions are taken in interpreting the results obtained.

The methods of nephelometry.—A nephelometer with a constant standard, A. A. WEINBERG (*Biochem. Ztschr.*, 125 (1921), No. 5-6, pp. 292-310, figs. 4).—Descriptions are given of the Kober (E. S. R., 45, p. 805) and Kleinmann (E. S. R., 45 p. 412) nephelometers, and the principal differences between the two are outlined.

A description with accompanying diagrams is also given of a nephelometer-colorimeter devised by the author. This is based on the principle of the Kober nephelometer, but has as its most significant feature a fixed standard consisting of a cylinder in which two Nicol prisms are placed, one capable of rotating above the other. Beneath the prisms is a place for the insertion of a colored glass. The new apparatus has a constant zero point and an experimental error of ± 0.5 per cent in five parallel readings.

The manufacture of cane sugar, L. JONES and F. I. SCARD (*London: Duckworth & Co.*, 1921, 2. ed., rev., pp. XIX+481, pls. 12, figs. 256).—A revised and enlarged edition of the volume previously noted (E. S. R., 24, p. 614).

The clarification of solutions containing reducing sugars by basic lead acetate.—The effect of different deleading agents, D. T. ENGLIS and C. Y. TSANG (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 4, pp. 865-867).—A comparative study is reported of the effect of the removal of basic lead acetate from solutions of glucose and fructose by means of potassium oxalate, disodium phosphate, potassium sulphate, potassium sodium tartrate, and sodium carbonate. The loss in weight of fructose with the various salts was much greater than that of glucose. Carbonates, sulphates, and oxalates, which have been employed most extensively as deleading agents, caused marked losses, while with disodium phosphate the loss was almost negligible. The latter is recommended as the most satisfactory deleading agent.

A precipitate obtained from cane juice after clarification with kieselguhr and decolorizing carbon, V. BIRCKNER (*La. Planter*, 68 (1922), No. 18, pp. 285, 286).—This contribution from the Bureau of Chemistry, U. S. D. A., reports an analysis of the gelatinous precipitate which appears in the course of the clarification of cane juice with kieselguhr and decolorizing carbons, as suggested by Zerban (E. S. R., 44, p. 14).

This precipitate was found to appear to a certain extent in the multiple effects and to increase when the sirup was heated to the boiling temperature. The precipitate yielded 79.4 per cent of ash containing 1.87 per cent moisture. Analysis of the ash gave the following results: SiO_2 35.6 per cent, P_2O_5 21.7, SO_3 3.2, CaO 10.0, Fe_2O_3 4.1, ZnO 6.7, MnO 0.6, and undetermined 18.1 per cent. A comparison of these figures with analyses of the ash of the kieselguhr and the decolorizing carbon used has led to the conclusion that the sirup precipitate can not be attributed primarily to either the kieselguhr or the carbon.

The selection of a vegetable carbon, W. H. DUNSTONE, JR. (*Facts About Sugar*, 14 (1922), No. 21, pp. 416, 417).—This is a general discussion of the factors which should govern the choice of a decolorizing medium for sugar purification.

Study of the solubility of crystallized strontium hydroxid, D. SIDERSKY (*Bul. Assoc. Chim. Sucr. et Distill.*, 39 (1921), No. 5, pp. 167-177, figs. 3).—Tables are given of the solubility of strontium hydroxid in water at temperatures of from 0 to 101.2° C and in sugar solutions of varying strengths at temperatures of from 3.15 to 40°. Formulas are also given for the calculation, from the percentage of sugar, of the amount of strontium hydroxid dissolved at these temperatures.

The utilization of final molasses, R. CARPENTIER (*Facts About Sugar*, 14 (1922), No. 20, pp. 390, 391, 392).—This is a discussion of the possibilities in the use of final molasses for the manufacture of fuel alcohol. It is considered that in sugar-producing countries where the price of gasoline is high such an industry can be established on a permanent paying basis. A description is given of the apparatus required for making the alcohol, and of the processes involved in converting some of the alcohol into ether and in denaturing the alcohol with ether, benzene, and pyridin bases to make a fuel mixture equal in power to present day gasoline.

Confectioners' raw materials, J. GRANT (*London: Edward Arnold & Co.*, 1921, pp. 1 + [2] + 173, pls. 4, nos. 23).—The various materials used in the manufacture of candy are discussed from the point of view of their sources, methods of preparation, chemical composition, impurities and adulterations, and their more important uses.

Manufacture of chemically pure dextrose, C. E. G. FORST and N. V. S. MUMFORD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 217, 218).—The method described is essentially a process of purifying "cerelose," a corn sugar made by allowing corn sirup to crystallize, cutting the resulting mass into slabs, pressing out the mother liquor, and drying the pulverized cake. This is first mixed in a kneading machine with sufficient water to give a mixture which can be handled in the centrifuge. The sugar obtained by centrifuging is dissolved in enough water to give a solution of 63 to 68° Brix. The liquid is heated at from 70 to 80° C, filtered through two barrel filters filled with bone black, and stored in 10-gal earthenware crocks, where it is allowed to crystallize spontaneously. It is then mixed, centrifuged at from 500 to 1,000 r. p. m. until most of the mother liquor has been removed and then at full speed, 1,500 r. p. m., wash water being added from a wash bottle. The sugar, containing from 20 to 30 per cent of moisture, is dried at a temperature of from 40 to 50° and then passed through a Mead mill to reduce it to a powder.

It is stated that the dextrose thus obtained has a purity of from 99.90 to 99.95 per cent.

Farm manufacture of unfermented apple juice, J. S. CALDWELL (*U. S. Dept. Agr., Farmers' Bul.* 1264 (1922), pp. 56, figs. 7).—This is a practical handbook on the manufacture of apple cider. A general discussion of the produc-

tion and uses of sweet cider, the essentials of a cider-making plant, and the selection of the fruit is followed by detailed descriptions of the best methods of preparing and preserving the juice. Two alternative methods for the preservation of the juice on a small or large scale are discussed, and full directions are given for each step of the various processes from the pressing of the juice to the final pasteurization. The essential difference in the two methods is that in one the juice is pasteurized without clarification and, after standing for a sufficient length of time, is siphoned off from the sediment and further clarified by passing through a pulp filter or milk separator and pasteurized again, while in the other the juice is clarified by filtration through diatomaceous earth, as described in a previous publication (E. S. R., 16, p. 616), and subjected to only one pasteurization.

In conclusion, a summary is given of the Federal regulations governing the manufacture and sale of cider and unfermented fruit juices.

Marmalade juice and jelly juice from citrus fruits, W. V. CRUICKSHANK and L. SINGH (*California Sta. Conc. 243* (1922), pp. 2, nos. 3).—As an outlet for cull oranges and lemons, the authors suggest the manufacture of two products which they have called citrus jelly juice and citrus marmalade juice. The former is prepared by boiling sliced oranges, lemons, or grapefruit, or a mixture of these fruits, with water and then expressing, clarifying, bottling, and sterilizing the liquid thus obtained. The marmalade juice is the citrus jelly juice to which from 10 to 20 per cent of boiled sliced peel has been added. Methods based upon the results of an investigation of the details of the process are given in full.

It is thought that these products possess sufficient merit to make their commercial production worthy of consideration by canners and manufacturers of citrus by-products. Of interest from the standpoint of the home preparation of pectin is the observation that a higher yield of pectin is obtained by the use of fruit cut to $\frac{1}{8}$ in. in thickness or less than from that cut $\frac{1}{4}$ in. or thicker and that the yield of pectin is increased if the fruit is boiled and leached with two lots of water for 15 minutes each instead of boiling once for $1\frac{1}{2}$ hours.

Practical tanning, A. ROGERS (*New York, Henry Carey Baird & Co., Inc.*, 1922, pp. XVI+699, nos. 125).—This is a handbook of modern practices and processes as applied in the manufacture of leather and allied products.

METEOROLOGY.

The general movements of the atmosphere and weather forecasting, P. GARRIGOT LAGRANGE (*Compt. Rend. Acad. Sci. Paris*], 174 (1922), No. 15, pp. 1028-1031; also in *Rev. Sci. Paris*], 60 (1922), No. 9, p. 316).—The author's general conclusion from his study of this subject is that a knowledge of the general movements of the atmosphere furnishes a basis for the determination of the character of successive periods, especially with reference to the distribution of pressure and temperature.

Variability v. uniformity in the Tropics, S. S. VISHNER (*Sci. Mo.*, 15 (1922), No. 1, pp. 22-34).—Reviewing observations at various widely scattered places in the Tropics, the author concludes that tropical climates are not so uniform as has been supposed, but that slight changes of weather are almost constantly taking place. It does not follow, however, that tropical climates are better adapted to civilized man than has been supposed, for "most of the variability within the Tropics is of a highly irregular sort compared with the variability characteristic of the parts of the higher latitudes where civilized man mostly lives. Indeed it appears that tropical climates are unfavorable for a high type of civilization, not alone because of the high temperatures and the general lack

of stimulating seasonal changes in temperatures but also because of the often extreme undependability of the rainfall, the occurrence not infrequently of destructive windstorms, and other unfavorable variations."

Some aspects of the use of the annual rings of trees in climatic study, A. E. DOUGLASS (*Sci. Mo.*, 15 (1922), No. 1, pp. 5-21).—This article is based upon studies which have been previously reviewed from other sources (*E. S. R.*, 42, p. 417; 43, p. 809; 47, p. 226), and deals particularly with the method of study of tree rings, their correlation with climate, and the possibility of utilizing the data in long-range weather forecasting.

"The correlations do not stop at rain and sunspot periodicity. The pines of northern Arizona which are so sensitive to rainfall show a strong half sunspot period. And on testing it one finds that the rainfall does the same, and that these variations are almost certainly related to corresponding temperature variations and to the solar period. Thus the Arizona trees are related to the weather, and the weather is related in a degree at least to the sun. Thus we find evidence in forest trees that the 11 year sunspot period prevails in widely different localities and in many places constitutes the major variation."

The application of the results of the study of tree rings to archeological work, especially in investigating the relative age of prehistoric ruins, is indicated.

The great dustfall of March 19, 1920, A. N. WINCHELL and E. R. MILLER (*Amer. Jour. Sci.*, 5 ser., 3 (1922), No. 203, pp. 349-364, fig. 1).—This article reports the latest of a series of studies undertaken "with the object of throwing light on (1) the probable origin of the dust, (2) the contribution of plant food to the soils of the Eastern States, and (3) the chemical relationships between American and European dustfalls."

Observations on the dustfall of March, 1918, have been noted (*E. S. R.*, 40, p. 616). "The storm of March 18-19, 1920, was more severe on the high plains, and less severe east of the Missouri Valley than the storm of March 8-9, 1918. Throughout the region between Denver and Cheyenne the 1920 storm was recorded as the worst March windstorm since 1901. . . . The dust storm prevailed as far east as St. Joseph, Kansas City, and Little Rock. . . ."

"The dust was mainly derived from the region of intensest wind, in north-eastern Colorado and southeastern Wyoming, and the supply of soil material in the air was augmented by smaller contributions from most of the southwestern States."

Chemical analyses and physical and mineralogical examinations of samples of the dust collected at Madison, Wis., as compared with dust collected and examined in other parts of the world, are reported. "In some respects the Madison dustfall resembles, in chemical composition, the loess of the Mississippi Valley. . . . Except as to the state of oxidation of the iron the Madison dust is closely similar to the loess from Kansas City studied by McCourt; it is also much like the loess from Dubuque and that from Kansas City examined by Chamberlin and Salisbury; it differs from the loess of Galena, Ill., and that from Mount Vernon, Iowa, in the scarcity of carbonates of calcium and magnesium."

Comparing this dust storm with that of Europe in 1901, it is stated that "the area of the latter was about 160,000 square miles, while the area covered by the American dustfall of 1920 was at least as great and probably several times greater. The total dustfall in Europe in 1901 was at least 1,782,200 metric tons, or 1,964,000 short tons. So far as the evidence goes it indicates that the American dustfall of 1920 involved at least as great a total, and probably several times as great a total amount of material transported."

The weather of western Washington, M. E. MCCOLLAM (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 2, pp. 26-30, fig. 1).—Tables based on

U. S. D. A. Weather Bureau records for 32 years are given which show the monthly and annual average rainfall and temperature for 1890 to 1921 and the 32-year averages. There is also a table of the frost-free periods for various localities in western Washington, and a map showing the average distribution of the rainfall.

In general the climate is characterized by a cool wet season from October to April and a warm dry season from May to September. The average monthly precipitation during the wet period is over 4 in. The driest weather occurs in July and August.

"Killing frosts quite often occur as late as May 15, but generally the last one is during April. The first killing frost in autumn usually occurs during late October."

The best month for seeding fall crops is October. The best time for fall plowing for spring crops is after the period of heaviest rainfall in November.

"The distinct decrease in rainfall during February and March should permit of early spring seeding of grain, vetch, clover, and grass, and field peas. The desirability of this early seeding in increasing yields has been well demonstrated. . .

"Crops requiring warm temperatures for germination, such as corn and mangels, had best be seeded during May, when a distinct rise in mean temperature is noted from 17.8° F. in April to 53° in May. Also it will be noted the frosts usually do not occur after May 15.

"The scarcity of rainfall and high temperatures in July and August emphasize the necessity of sufficient soil moisture and thorough cultivation during this period.

"Rainfall figures for August (1.06 in.) and September (3.09 in.) show the advantage of completing grain harvest during August. Usually if delayed until September, the grain is damaged by rains."

[**Weather reports for Alaska, 1920**] (*Alaska Stas. Rpt. 1920*, pp. 20-22, 36, 37, 48-50, 58, 59, 67-75, fig. 1). Tabular summaries of observations on temperature, precipitation, and cloudiness at 35 Weather Bureau stations in Alaska are given, and weather conditions in relation to crop production and other kinds of farm work at the Rampart, Fairbanks, Matanuska, and Kodiak Stations are briefly discussed.

The rainfall of the British Isles, M. DE C. S. SALIER (*London: Univ. London Press, Ltd., 1921*, pp. XIII+295, pl. 1, figs. 126; rev. in *Nature* [London], 109 (1922), No. 2736, pp. 440, 441). This book summarizes information which has previously been published in various volumes of British Rainfall, discusses types and exposure of gauges and other problems connected with the accurate measurement of rainfall, explains methods of handling rainfall data and comparing types of rain, especially by the use of maps, shows seasonal and annual fluctuations in rainfall in the British Isles, and sets forth the economic applications of the rainfall data with special reference to distribution and droughts and the flow of streams.

It is stated that, as regards rainfall, the British Isles are greatly favored, "the bulk of the rainfall being orographical. The mountainous districts, which lie principally in the west, enjoy a sufficiently large and continuous rainfall to feed numerous rivers, which carry away their superfluous precipitation across the relatively drier plains of the east. The continual renewal of the supply of water in excess of the actual needs of vegetation allows of large accumulations in the permeable underground strata, such as chalk and sandstone, so that even in the event of long periods of rainless weather, supplies can usually be obtained from springs or borings."

SOILS--FERTILIZERS.

Studies on a drained marsh soil unproductive for peas, P. S. BURGESS (*Calif. Univ. Publ. Agr. Sci.*, 4 (1922), No. 11, 339-396, figs. 21). Field and greenhouse studies of a drained, heavy clay loam, acid marsh soil of the San Francisco Bay region, which was unproductive for certain crops and contained small percentages of the white alkali salts, notably sulphates, are reported. The studies included the use of a variety of fertilizing materials and investigation of soil water extracts to ascertain the rates of formation as well as the absolute amounts of soluble salts formed in the soil under the influence of different factors. This work was supplemented by hydrogen-ion determinations and conductivity measurements.

Nitrification studies showed that the addition of calcium carbonate to neutrality greatly increased nitrate production, while soluble phosphorus and potassium compounds without lime produced no effect. Ammonification was due largely to soil fauna and the *Azotobacter* species were absent. A statistical study of the factor of variability, where certain water-soluble ions within soil extracts were taken as the criteria, showed that apparently uniform field soils may vary greatly within small areas.

In the field, water was apparently the limiting factor in crop production in one case. Under these conditions superphosphate applied at the rate of 1 ton per acre increased yields by approximately 25 per cent, while liming to neutrality gave no increase. It was found that the acid phosphate applications greatly enhanced the solubility of soil potassium, magnesium, and calcium, while nitrate production was affected but slightly. The rapid reversion of soluble phosphate within this soil was thought to be due largely to the formation of aluminum phosphate, since a small amount of aluminum-ion was always present in water extracts of this soil. Ferrous compounds or other toxic materials, aside from the white alkali salts, were not found.

In the greenhouse, where moisture and temperature conditions were optimum, much larger plants were produced. A 25 per cent increase in yield of total dry matter attended the use of calcium carbonate when added to neutrality, and a 28 per cent increase where superphosphate was applied at the rate of 1 ton per acre. The soils receiving gypsum treatments and the check soils were about equal in productivity, while sodium nitrate and potassium sulphate, when added at the rate of 500 lbs. per acre, gave slight but insignificant losses. Nitrates completely inhibited nodule formation in this soil, while calcium carbonate added to neutrality acted similarly. Soluble phosphorus increased nodule formation, while potassium sulphate and gypsum produced no noticeable effects.

All of the chemical compounds added increased the concentration of the soil solutions under the growing crops although marked differences between the several treatments were noted. A direct relationship existed between the concentration of solutes present in the soil extracts, as shown by conductivity measurements and crop production. Gypsum was the most active in the liberation of soil potassium, and was equal to any other compound in effecting the solution of soil magnesium. It had no action upon phosphorus availability or nitrate formation. Calcium carbonate, when added to neutrality, was apparently the most effective soil solvent applied, although its action is considered to be largely indirect. It occupied first place in effecting the solution of all ions excepting potassium. In comparison with the checks, specific resistance was here decreased by almost one-half. Nitrate production was nearly trebled, as was also water-soluble magnesium. Soluble calcium was increased many fold, and soluble potassium and phosphoric acid were each increased by at

least one-third. With the possible exception of nitrate-ion concentration, there was no declining tendency noticed on the part of any of the nutritive ions during maximum withdrawal by the heavy pea crop produced.

The enhanced solubility of soil minerals due to superphosphate applications is considered to be largely due to the gypsum which this material contains. Sodium nitrate had little effect on the solubility of this soil in water. Potassium sulphate increased the solubility of calcium and magnesium, while nitrate formation and phosphate availability were apparently unaffected. The results secured from two salt applications, both as regards yields and soil solubilities, were approximately the same as the average of the similar individual single salt treatments.

Studies of H-ion concentration of the pot soils throughout the cropping period showed that all of the soils to which neutral salts were applied were slightly but consistently less acid than were the checks. Superphosphate especially tended to lower the H-ion concentration. During heavy nitrate absorption there was a slow, definite increase in soil alkalinity. On the other hand, where calcium carbonate was added to neutrality a progressive increase in H-ion concentration was recorded.

The results, when cropped and fallowed soils were compared, differed but slightly, the chief dissimilarity being that the water extracts of the fallowed soils reached maximum concentrations about a month later than did those of the cropped soils, and thereafter remained stationary or gradually decreased. Larger amounts of solutes were as a rule present in the uncropped soils, but the same comparative relationships almost invariably held.

Analyses of soils of Pierce County (Ga.). W. A. WORSTAM, JR., L. M. CARTER, M. W. LOWRY, and W. O. COLLINS (*Ga. Agr. Col. Bul.* 248 (1921), pp. 36, figs. 5, map 1).—This report supplements the report of the physical survey of the soils of the county, made in cooperation with the U. S. Department of Agriculture (E. S. R., 44, p. 211), and presents and discusses the results of chemical analyses of typical samples of each soil type found in the county. These indicate that the principal soils of the county are deficient in nitrogen, phosphoric acid, and potash, and that nitrogen and organic matter are the limiting factors in soil fertility. Next in importance to nitrogen and organic matter is the need of an increased supply of phosphoric acid.

Studies in West Indian soils.—II. The soils of Montserrat, their natural history and chief physical properties, and the relationship of these to the problem of die-back of lime trees, F. HARDY (*West Indian Bul.*, 19 (1922), No. 2, pp. 189–213, pl. 1).—In a second report on West Indian soils (E. S. R., 46, p. 815), a study is reported of the natural history and chief physical properties of the soils of Montserrat.

Montserrat belongs to a continuous chain of islands that constitute the volcanic zone of the Antilles. The rocks of which Montserrat is composed consist almost entirely of fragmental material derived from igneous rocks of subalkaline type, chiefly hypersthene-andesite and trachyte. This material has been consolidated into agglomerates, breccias, and tuffs. Erosion has produced several conspicuous talus slopes, which occur chiefly in the southern part of the island. These consist of masses of loose debris overlying the consolidated rocks in layers of varying thicknesses. Water action has cut numerous ravines in their surfaces. In the northern part of Montserrat the consolidated rocks appear near or at the surface and have suffered intense denudation.

In accordance with the geological nature of the substratum, the soils of Montserrat are classified as talus soils and shoal soils, the former being transported and the latter sedentary soils. They differ chiefly in the degree to which their subsols provide free drainage. The shoal soils are divided into humd up-

land soils, hilly land soils, and valley soils. The agencies that have given rise to these subtypes are mainly climatical and topographical in nature.

Data on the chief physical features of the types and subtypes obtained in a laboratory examination of representative samples are presented in tabular form and discussed. The humid upland soils are markedly acid in reaction and exhibit incipient lateritization. The soils when dry are of a reddish or yellowish color, showing the presence of an excess of iron oxid. They are distinctly colloidal in type, and possess high water capacities and low permeabilities. Their subsoils are clayey and of varying depth.

The hilly land soils are said to be generally infertile. These soils are shallow and are excessively drained. Their texture is mainly sandy, and most of the colloidal matter has been washed out. They are of low retentivity and vary in type between sandy loams and clay loams. They are pale reddish brown in color when dry and may be slightly acid, neutral, or distinctly alkaline in reaction. The valley soils are said to be of considerable fertility. They are sandy loams or clay loams with good underdrainage and are not subject to drought. They are similar in physical characteristics to certain of the hilly land soils.

In the second part of this report die back of lime trees in Montserrat is presented in historical and general outline. It is considered that the chief factors responsible for die back are intimately connected with the water relations between the lime trees and their environment.

In part 3 of the report an outline is given of the laboratory methods used in the examination of soil samples.

The ecological significance of soil shrinkage, T. G. MASON (*West Indian Bul.*, 19 (1922), No. 2, pp. 125-137) - In this paper attention is drawn to a correlation established by Watts between the condition of the cacao grown in certain valleys of Dominica and the percentage linear shrinkage of the soil on air drying. The cacao failed to thrive where the shrinkage exceeded 10 per cent.

Studies to elucidate the significance of this relationship are described in which comparisons were made of the percentage of shrinkage of a number of soils with their moisture residues at permanent wilting, and the percentage of moisture in the soil at the point of maximum plasticity. The conclusion is drawn that the amount of shrinkage exhibited by any soil on air drying is not determined solely by its colloidality or degree of dispersion, but is dependent also upon the degree of aggregation of the particles into compound grains, the greater the dispersion and the less the aggregation, the greater being the shrinkage for a given temperature, rate of evaporation, etc.

The poor condition of the cacao under the particular complex of the environmental conditions of these valleys, when rooted in soils the linear shrinkage of which exceeded 10 per cent, is provisionally ascribed to the degree of diffusion of colloids in such soils and not merely to their colloidal content. Diffusion of soil colloids is considered to render the soils impermeable to water, especially under conditions of prolonged and heavy rainfall.

The laterite soils of Formosa Island [Taiwan], K. SHIBUYA (*Soil Sci.*, 13 (1922), No. 6, pp. 425-431) - In a contribution from the Government Soil Survey of Taiwan, Japan, an investigation of Taiwan laterite is briefly described. This laterite is derived from tertiary rocks. It is not the same as Indian laterite, but belongs to the laterite class in a broad sense. This soil covers the diluvial formation in the island and usually forms hills or plateaus. It contains oxids, hydrates, and silicates of aluminum and iron, which function principally by virtue of their colloidal nature. The soil is said to be deficient in fertility constituents, particularly in nitrogen and phosphoric acid. Micro-

scopic examinations permitted the identification of quartz, amorphous silica, hematite, magnetite, tourmalin, and zircon. The characteristic deep red color of this soil is said to depend in general upon the iron oxid content, and particularly upon its distribution throughout the soil grams.

Further studies on the soluble salt content of field soils, C. E. MILLAR (*Soil Sci.*, 13 (1922), No. 6, pp. 435-448).—In a continuation of studies conducted at the Michigan Experiment Station, previously noted (E. S. R., 40, p. 512), additional evidence was secured during 1919 that the soluble salt content of the surface 6 in. of soils free of vegetation is quite low in the early spring and late fall, but reaches a somewhat higher concentration some time during the summer. The salt content of the 6 to 12 in. section was found to be usually quite low and showed no tendency to reach a maximum during summer. Plant growth modified the amount of soluble material in the 4 to 6 in. section and tended to prevent the accumulation of soluble salts at the surface of the soil. When no vegetation was present, soluble substances tended to accumulate in the 4-in. soil section, especially during dry periods.

Rainfall was found to be an important factor in the distribution of soluble materials in the soil strata. The data also indicated that factors other than rainfall materially influence the accumulation and distribution of salts in field soils. The incorporation of the organic matter of several virgin soils throughout the surface 6 in. section by hoeing did not lead to a more rapid production of soluble material than was noted when these soils were maintained free of vegetation but not cultivated.

The physiological humidity of the soil and its direct determination, T. G. MASON (*West Indian Bul.*, 19 (1922), No. 2, pp. 137-154, 169-171).—In a contribution from the Imperial Department of Agriculture for the West Indies, an outline is given of the more important methods which have been employed in the determination of the physiological moisture conditions of the soil, and a simple method of measuring the water-supplying powers of soils directly by means of lead (writing) pencils is described.

In studies with seven soils of varying texture using this method, it was found that at the time corresponding to the permanent wilting of the plants the values obtained showed a close agreement. A high degree of correlation was found to exist between the colloid content of the soil, as measured by the water of imbibition at the point of maximum plasticity, and the soil moisture residues at permanent wilting.

Examination of soil gases, F. J. WARRI (*Agr. Research Inst., Pusa, Sci. Rpts.*, 1920-21, pp. 24, 25).—The results of carbon dioxide determinations on grassed and cultivated soils for two complete seasons are reported and discussed.

The fluctuations due to season and cultivation, respectively, were very similar during the two seasons. The ratio of oxygen to carbon dioxide showed striking differences between the grassed and cultivated soils, varying between 86 and 60 for the latter and between 63.6 and 8.3 for the former.

Soil biology, J. H. WALTON (*Agr. Research Inst., Pusa, Sci. Rpts.*, 1920-21, pp. 28, 29).—Determinations of the nitrogen losses from cattle dung and urine during storage under aerobic and anaerobic conditions showed that the losses from the former were comparatively small, but that the urine lost 85 per cent of its nitrogen under aerobic and only 15 per cent under anaerobic conditions.

Pot experiments with oats manured with cow dung and urine, stored under different conditions, showed that the yields corresponded to the amount of nitrate formation in nitrification experiments in the laboratory. Similar results with oats were obtained from pots and plats manured with green manure, including roots, stems, and leaves taken separately and the whole plant.

The primary results of a series of experiments on the dissolving of rock phosphate by composting with cake or green manure indicated that even in a highly calcareous soil dissolving of phosphate by composting does take place. Experiments on the nitrification of mahua cake showed that the addition of fresh cake lowered the percentage of nitrate nitrogen in the soil to zero. This effect persisted for about four weeks, after which small quantities of nitrate were found, but these in no case exceeded those present in the soil at the beginning. Nitrification of the cake was not improved by simple fermentation, but composting the cake with rock phosphate or with rock phosphate and sulphur for four weeks resulted in 25 per cent of the nitrogen of the cake becoming nitrifiable, and in one case the nitrate formed rose to 45 per cent.

[**Soil studies by the New York State Station**] (*New York State Sta. Rpt. 1921, pp. 17, 18*).--The first five years' results of lysimeter investigations have shown that a Volusia soil under a 4 year rotation, including two years of alfalfa, has lost over seven times as much nitrate nitrogen as has the same soil under a rotation in which two years of timothy replaced the alfalfa. In spite of the greater loss of nitrate under an alfalfa rotation this soil has given an increase of 4.370 lbs. per acre in the barley crop succeeding alfalfa over barley after timothy. This increase was also reflected in the wheat crop the following year.

Results of outdoor cylinder experiments on the response of certain crops of high mineral requirement to varying amounts of calcium and magnesium limestone showed that both forms of limestone, in amounts far below the lime requirements of the soil, will produce normal yields especially of alfalfa. In some cases the small applications gave more satisfactory returns than the large ones.

Studies of nitrogen changes in manure showed that acid phosphate was the most efficient preserving agent among those tried, including peat, straw, soil, gypsum, and rock phosphate, and a combination of these with straw as litter. Acid phosphate not only held more of the nitrogen but appeared also to conserve the organic matter in the manure. Such a manure gave the best results in vegetation experiments. Peat also had a considerable value as a preservative. Fresh straw had a detrimental effect on plants.

Organic matter studies, F. J. SLEWERS (*Washington Col. Sta. Bul. 167 (1922), pp. 45, 46*)--Studies on the effect of returning straw and crop residues to soil are said to show that the nitrogen-carbon ratio in the materials returned has a very pronounced influence on the kind and rate of decomposition. Organic materials like straw, having a wide nitrogen-carbon ratio, when applied to the soil will produce a depressing effect on the nitrate development, and such effect will be felt until there has been sufficient decomposition to cause this ratio to approach that of the organic matter in the soil. Before this stage of decomposition is reached nearly all of the carbon is lost as carbon dioxide, and consequently residues like straw can not be depended upon to materially influence the soil organic matter. Where organic matter having a narrow nitrogen-carbon ratio like legume hay, legume green manure, or legume sod is incorporated in the soil, there is an immediate and rapid nitrate development. There is also less loss of carbon dioxide and an indication of greater organic matter maintenance.

Influence of salts on azofication in soil, J. E. GREAVES, E. G. CARTER, and Y. LUND (*Soil Sci., 13 (1922), No. 6, pp. 481-499*).--In a continuation of work previously noted (*E. S. R., 40, p. 722*), studies conducted at the Utah Experiment Station on the action of compounds previously tested on nitrogen fixation in a loose calcareous sandy loam soil very high in acid-soluble constitu-

cants, are reported. The toxicity of the chlorides, nitrates, sulphates, and carbonates of sodium, potassium, calcium, magnesium, manganese, and iron as determined by nitrogen fixation was found to be governed by the specific salt and not by the electronegative ion, as was the case with ammonification. The nitrogen fixing bacteria were similar to the nitrifying bacteria in this respect. These salts were all less toxic to nitrogen-fixing bacteria in the soil than they were to the ammonifying or nitrifying bacteria. The quantity of a salt which could be applied to a soil without decreasing the nitrogen gains varied with the salt. None of the sodium salts were toxic when 460 parts per million of sodium in the form of the various salts was applied to the soil. Calcium nitrate, sulphate, and carbonate at 400 parts per million, magnesium chloride and sulphate at 243, manganous nitrate at 550, and ferric chloride at 372 parts, were not toxic. The remaining salts became toxic at some concentration tested, in the following order: $MgCO_3$, $Mg(NO_3)_2$, K_2CO_3 , $FeCO_3$, $MnCO_3$, $Fe(NO_3)_3$, $Fe(SO_4)_3$, $CaCl_2$, $MnCl_2$, KCl , K_2SO_4 , KNO_3 , and $MnSO_4$.

KCl , K_2CO_3 , $MnCO_3$, and $Fe_2(SO_4)_3$ failed to stimulate the nitrogen-fixing organisms in any of the concentrations tested. All the others stimulated the organisms in the following order: $Ca(NO_3)_2$, Na_2CO_3 , K_2SO_4 , Na_2SO_4 , $FeCl_3$, $CaCO_3$, $NaCl$, $NaNO_3$, $MnSO_4$, $CaSO_4$, $MnCl_2$, $Mn(NO_3)_2$, $MgCl_2$, $Fe(NO_3)_3$, $Mg(NO_3)_2$, $MgCO_3$, $FeCO_3$, $MgSO_4$, KNO_3 , and $CaCl_2$.

The common soil alkalis would have to be present in soil in sufficient quantities to greatly retard ammonification, nitrification, and plant growth before they would retard nitrogen fixation, provided the soil was not acid and was supplied with the necessary nutrients for the functioning of the azofiers. The nitrogen fixing bacteria were more resistant to these salts than the ammonifiers, nitrifiers, or most higher plants.

Factors that control the infection of legumes by bacteria, W. I. NIGHTINGALE, (*Washington Col. Sta. Bul.* 167 (1922), p. 17). Field and greenhouse studies on seven common legumes inoculated with 34 different strains of bacteria to study the effect of their virulence, in which the soil, water, and milk methods of applying the bacteria to the seed were used, are said to have shown that the soil method gave the best results, although there was little difference in nodule formation between the soil and water methods. The number of bacteria applied to the seed is said to be of less importance than the virulence of the bacteria on the number of nodules formed.

The effect of lime, leaching, form of phosphate and nitrogen salt on plant and soil acidity, and the relation of these to the feeding power of the plant, F. C. BARBER and A. R. C. HAYS (*Soil Sci.*, 13 (1922), No. 6, pp. 461-479, figs. 9). Studies conducted at the Wisconsin Experiment Station are reported, the purpose of which was to investigate the effect of leaching and certain fertilizer treatments on the acidity of the soil medium and plant juices, and to determine whether the acidity bears any relationship to the feeding power of the plant. For this purpose soy beans and corn were grown in quartz sand cultures which were variously treated with rock phosphate, acid phosphate, limestone, sodium nitrate, and ammonium nitrate. One series of the corn cultures was leached and the other was not. The acidity determinations of the plant juices included the determination of both the H-ion concentration and the total acidity.

Ground limestone, leaching, and the form of phosphate and nitrogen salt had a marked effect on the acidity of the soil medium and plant juices. The acidity was closely related to the growth and feeding powers of the plants. The use of ground limestone with soy beans increased the amounts of soluble calcium in the soil solution, and hence lessened the actual acidity of the soil and in general the actual acidity of the juices of the plant. In a few cases the

limestone appeared to increase the vigor of growth, which was accompanied by increased acidity of the plant juices. Leaching the corn cultures removed soluble bases from the soil and hence increased its actual acidity, and usually also the actual acidity of the juices of the plant. Acid phosphate always produced greater actual acidity or less alkalinity in the soil and usually greater actual acidity in the plant juices than did rock phosphate. Greater actual acidity in the soil and plant juices caused a greater availability of rock phosphate to the plant.

Ammonium nitrate compared with sodium nitrate on corn had a marked influence in increasing the actual acidity of the soil and root juices, but an indifferent effect on the acidity of the top portions of the plant. The total acidity of the roots of the soy bean plant did not increase with increasing actual acidity. With the corn plant, however, the total acidity increased with the increase of actual acidity in the juices of both the tops and roots. In general, the total acidity of the corn tops was greater than that of the roots. The total acidity of the corn tops was usually greater when sodium nitrate was used than when ammonium nitrate was used.

In the two determinations made, ground limestone appeared to lessen the actual acidity of the juice of soy bean nodules to a greater extent than it did the actual acidity of the juice of the roots on which the nodules grew. The variation in the actual acidity of the juice of the soy nodules due to liming was in the same direction as the variation in the actual acidity of the juices of the top portions of the plant.

Acid soil studies.— III, The influence of calcium carbonate, calcium oxid, and calcium sulphate on the soluble soil nutrients of acid soils, R. H. ROBINSON and D. E. BULLIS (*Soil Sci.*, 13 (1922), No. 6, pp. 449-459) — In a third contribution to the subject (*E. S. R.*, 45, p. 514), studies conducted at the Oregon Experiment Station are reported on the effects of calcium carbonate, calcium oxid, and calcium sulphate on the soluble nutrients of five different acid soils, including two silt loams, sandy loam, gravelly loam, and brown clay loam.

The main differential factor was found to be the rapid development of a comparatively large amount of nitrates, due to treatment with calcium carbonate or calcium oxid, in those soils that responded to lime treatment, while the other soils showed much smaller increases in nitrates after similar treatment. The water-soluble phosphorus and sulphur were very low in all the soils and did not change appreciably, due to the effects of the various treatments. Treatment of all the soils with calcium sulphate increased the water-soluble magnesium and potassium.

In pot experiments mono-calcium phosphate and mono-calcium phosphate and lime caused an increase in nitrates in those soils that did not respond to lime alone. Field tests did not confirm these results. Periodic determinations of nitrates in field plats showed that the silt loam soils nitrified rapidly when treated with limestone, while the gravelly loam soil showed very little increase.

Liming as a means of soil amendment, F. HARDY (*West Indian Bul.*, 19 (1922), No. 2, pp. 161-189).—A review is presented of the main factors included in different theories on the effect of liming on the physical and chemical composition of the soil, with particular reference to the soil reaction. Attention is also given to lime deficiency in certain soils, the antagonistic effect of calcium-ions in the soil solution, precipitation of toxic substances in the soil solution by liming, and the possible indirect fertilizing influence of lime. Lime requirement determination methods are also discussed.

It is concluded that soil acidity is not always an objectionable condition which invariably requires an application of lime for its correction and that, in fact, soil acidity may in certain instances be beneficial in controlling plant diseases or in preventing malnutrition. The importance of detailed investigation is emphasized, in order to settle definitely which of the factors known to be associated with an acid reaction are fundamentally responsible for the low productivity of certain acid soils growing specific crops.

Plant indicators of soil types, A. P. KELLEY (*Soil Sci.* 13 (1922), No. 6, pp. 411-423).—In a contribution from the University of Pennsylvania, studies are reported, the object of which was to determine whether a general H-ion concentration may be assigned to each of the soil types of southeastern Pennsylvania, and whether a definite relation exists between these soils and the flora growing upon them. Five different loam soils were included in the study.

In soil testing the colorimetric method was used as being the most practical for field tests. The carbon dioxide of the soil solution was not found to affect the pH value in the tests. The acidity of a soil type is a variable quantity but an average pH value may be assigned to each type. Soil acidity is governed in part by such factors as arrested leaf decay and physiographic features of slope, degree of slope, and relative elevation. Some types of soil seem to have a higher degree of acidity in late summer. Soil acidity was found to influence flora to such an extent that certain plants may be assigned as indicators, a number being listed for each type. It is thought that soil acidity may induce variation in plant species.

The reaction of soils in the field as influenced by the long-continued use of fertilizer chemicals, P. S. BURGESS (*Rhode Island Sta. Bul.* 189 (1922), pp. 4-36). This bulletin presents certain data which show the effects of long-continued fertilizer treatments on the reaction of field and cylinder soils similarly cropped and otherwise similarly treated.

Thomas slag, acid phosphate, ground bone, floats, and double superphosphate all tended to reduce soil acidity somewhat. The first three were especially active. There was no foundation for the statement that soils become more acid from the continuous use of acid phosphate. Finely ground starfish and sodium nitrate decidedly reduced soil acidity, while horn meal, dried blood, acid fish, hoof meal, tankage, and hen manure slightly but consistently increased it. Ammonium sulphate greatly increased soil acidity. All of the potassium salts reduced soil acidity slightly. Kainit was the most active in this respect, followed in order by the double manure salt, the muriate, and the sulphate, although the differences nowhere were great. The carbonates of sodium and potassium greatly reduced soil acidity in comparison with the chlorids of these elements and, per calculated equivalent of calcium oxid, appeared to be approximately twice as effective as carriers of calcium oxid. Nonleguminous green manure crops annually turned under for long periods slightly decreased soil acidity, while leguminous cover crops similarly incorporated with soils tended to increase the acidity appreciably.

Results of fertilizer experiments, 1919, 1920, 1921, M. NELSON and W. H. SACHS (*Arkansas Sta. Bul.* 180 (1922), pp. 3-23).—The results of fertilizer experiments with cotton, corn, and sorghum conducted at rather widely distributed points throughout Arkansas during 1919, 1920, and 1921 are summarized in this bulletin.

Farm manure was found to be one of the best fertilizers, particularly when reinforced with acid phosphate. Commercial fertilizers were usually used more profitably on cotton than on corn. Complete fertilizers were generally

the most effective on the upland soils, while the heavier soils containing considerable clay required little or no potash.

Delta soils that have been cropped for years were found to require phosphoric acid and nitrogen, while well-drained soils well supplied with organic matter require only phosphoric acid for cotton.

More profitable returns have been obtained from small or medium applications of high-grade commercial fertilizer than from large applications.

[Soil fertility studies], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1921, pp. 20-24*).—The progress results of soil fertility studies at the different station farms in North Carolina are summarized (*E. S. R.*, 15, p. 423). The results as a whole apparently confirm those established during the previous year. In addition, it has been found that on most of the farms acid phosphate is a better carrier of phosphoric acid than finely ground rock phosphate, soft phosphate, or basic slag, and profitable results seem to have been obtained from the use of lime on the different soils. In most cases also sodium nitrate and ammonium sulphate appeared to be the most effective carriers of nitrogen.

Soil nitrate studies, F. J. SILVERS (*Washington Col. Sta. Bul. 167 (1922), pp. 44, 45*).—It is stated that applications of sodium nitrate and ammonium sulphate to soils in which available nitrogen is the limiting fertility factor produced marked increases in the yield of wheat after every application for three successive years. The best yields were obtained from spring applications of fertilizers on winter wheat. Nitrogen fertilizers when applied with straw were effective in overcoming the depressing influence of the straw. Under field conditions where nitrates were not limited, the lightest seeding of winter wheat produced the greatest amount of tillering.

Further experiments with activated sludge, E. H. RICHARDS and G. C. SAWYER (*Jour. Soc. Chem. Indus.*, 41 (1922), No. 5, pp. 627-727).—Laboratory and sewage works experiments and field trials on the fertilizing value of activated sludge conducted by the Rothamsted Experimental station, are reported.

The laboratory experiments showed that if activated sludge is aerated for a short period in an ammoniacal solution the recovery of nitrogen is quantitative. The nitrogen not found as ammonia or nitrate in the effluent is recovered in the sludge. If aeration is continued loss of nitrogen occurs, the loss being roughly inversely proportional to the volume of sludge present. The same effects were observed with sewage. The ammonia falls while the sludge gains nitrogen, with a loss of nitrogen on the whole balance after 16 days' operation. Considerable evidence was obtained that the extra nitrogen in activated sludge, over and above that found in the old type sludges, is derived from the ammonia of sewage. There was no evidence of fixation of atmospheric nitrogen.

The numbers of protozoa in well-activated sludge approximated to 1,000,000 per gram of wet sludge. It is thought that the cell content of these organisms alone may account for a large proportion of extra nitrogen.

A complete correlation was established between the numbers of active protozoa and bacteria in activated sludge under varied working conditions. The increase in bacterial numbers following suppression of protozoa produced no improvement in the purification of sewage. There was, however, a change in bacterial flora, nitrifying organisms being suppressed by partial sterilization. When nitrifying organisms were reintroduced a greater quantity of nitrate was found in the partially sterilized than in the untreated sewage. No decision was reached as to whether this results from a large production or a decreased destruction of nitrate.

Tank experiments, conducted at the Harpenden Sewage Works, showed that activated sludge produced from a domestic sewage of somewhat above average

strength with a small proportion of detritus contained from 5.5 to 6.8 per cent of nitrogen, calculated on the dried sludge. Very great variations in the volume of air, strength of sewage, amount of sludge in the tank, and time of retention produced no appreciable change in the nitrogen content of the sludge. Observations made during the operation of the experimental tank confirmed the laboratory experiments in regard to the source of the extra nitrogen content of activated sludge as compared with ordinary sewage sludges. These observations afforded no evidence of fixation of atmospheric nitrogen, but suggested that in addition to colloidal nitrogen, ammonia is removed from the sewage by physical or by biological means or both.

Under strongly aerobic conditions and with less than 25 per cent of sludge in the tank, the recovery of sludge was practically quantitative. When the aeration was moderate to poor, and the volume of sludge 50 per cent or more, over half the dry matter in the suspended solids of the sewage disappeared. Variation of operating conditions, as noted above, influenced the nitrogen changes in a similar way, but there was always a loss of nitrogen. Under favorable conditions 20 per cent, and under unfavorable conditions 80 per cent, of the nitrogen left in the tank was not recovered. The proportion of total nitrogen in the Harpenden sewage recovered in normal operation by the activated sludge process was found to be greater than in the older methods of sewage purification, being 15 per cent as compared with 10 per cent by precipitation and 4 per cent by septic tanks. With sewage of one-half the average strength and supplying twice the normal volume of air per gallon of sewage, the recovery of nitrogen was as high as 27 per cent of the total nitrogen in the sewage.

Field trials on the fertilizing value of activated sludge, when applied to grass, barley, or potatoes, showed that the activated sludge gave good yields in comparison with ammonium sulphate or barnyard manure when applied to give equal weights of nitrogen. Dried sludge gave very uniform results in pots, but the wet sludge gave much greater differences between the yields of individual plats than is usual in this class of work. The results are taken to indicate that activated sludge has a high fertilizing value in marked contrast with the old type sewage sludges.

Experiments with "radio" manure, T. H. PATERSON (*New Zeal. Jour. Agr.*, 24 (1922), No. 1, pp. 33-35).—The results of the second year of the studies on this subject (E. S. R., 46, p. 221) are presented in this report.

It was found that coal dust lowered the yield wherever it was used. The addition of lime or superphosphate increased yields. The addition of coal dust to superphosphate or to a mixture of superphosphate and lime decreased the fertilizing value of the final mixture. It is considered clear that the so-called radio mixture would be better without the coal dust, as this affects adversely the good effects of the other ingredients.

Experiments on the use of radio manure as a top-dressing for permanent pasture showed that the results from the radio plat compared very unfavorably with results from plats treated with basic slag, guano, or superphosphate.

Effect of borax in fertilizer on the growth and yield of potatoes, B. E. BROWN (*U. S. Dept. Agr. Bul.* 998 (1922), pp. 8, pls. 4, fig. 1).—Experiments conducted by this Department, in cooperation with the Maine Experiment Station, to determine the influence of borax on potatoes in Caribou loam soil are reported.

Injury definitely occurred with an application as low as 5 lbs. of borax per acre when put in the furrow and when the planting was done immediately. Broadcasting at the time of planting and applying in the furrow some time before planting did not show injury in as low concentrations of borax as when

the fertilizer-borax mixtures were applied in the furrow at the time of planting. As the quantity of borax was increased the injury in all cases became progressively worse, until, with the larger quantities of borax per acre, great injury ensued.

The moderate and fairly regular rainfall during the month of June was not sufficient to carry the borax out of the reach of the growing plant, so that no alleviation of the injurious action was noticeable.

The types of injury observed in the commercial fields during 1919 were similar to those found in the borax experiments of 1920. Some of the reactions with borax observed in both seasons were failure of the seed piece to germinate, the killing of sprouts, the absence of roots at seed pieces, general weakness of plants which came through the ground, bleaching of the foliage, or at least a marginal yellowing of the leaf, a poor stand, and low yields.

Fertilizer inspections in New Jersey from 1880 to 1921. C. S. CATHCART (*New Jersey Stat. Bul.* 368 (1922), pp. 24, figs. 6).—This is a summarized report of the principal facts which have been brought out from year to year by the official fertilizer inspection work in New Jersey during the period from 1880 to 1921. It reflects in a statistical way the changes which have occurred in the amounts and kinds of fertilizers used in the State since the establishment of the station.

The records of 39 years show that 3,250,000 tons of fertilizers have been sold in the State. During the 42-year period the average wholesale cost per pound of nitrogen in sodium nitrate has varied from 10.4 to 30.17 cts., in ammonium sulphate from 10.8 to 32.82 cts., and in dried blood from 9.9 to 44.84 cts. The wholesale cost per pound of potash when obtainable in the form of muriate varied from 3.3 to 31.02 cts., in sulphate from 4 to 17.03 cts., in double manure salts from 4.2 to 5.67 cts., and in kainit from 2.9 to 5 cts. The cost of available phosphoric acid varied from 2.6 to 6.36 cts. per pound.

Data are also given on the materials used in making mixed fertilizers and on the average composition of different mixed fertilizers. These are taken to indicate that the farmers of New Jersey have evidently appreciated for some years the wisdom of purchasing the higher grade goods.

AGRICULTURAL BOTANY.

Practical plant biochemistry, M. W. ONSLOW (*Cambridge, Eng.: Univ. Press, 1920*, pp. [7] + 178).—This book is intended primarily to fill, for students of botany, the gap between organic chemistry and plant physiology. It is essentially a textbook for practical work. A student is expected to be able, by employing the experiments offered, to extract from the plant itself its chemical constituents. An elementary knowledge of organic chemistry is assumed. The several chapters following the introduction deal with the colloidal state, enzym action, carbon assimilation, carbohydrates and their hydrolyzing enzymes, the fats and lipases, aromatic compounds and oxidizing enzymes, the proteins and proteases, glucosids and glucosid-splitting enzymes, and the plant bases. Each chapter is followed by a list of references to related publications.

Conductivity and permeability, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 4 (1921), No. 1, pp. 1-9, figs. 3).—When an electrical current passes from a salt solution into a living cell, ions must enter the protoplasm. An increase in the permeability of the protoplasm to ions must decrease its electrical resistance, and vice versa. The electrical resistance of the protoplasm may, therefore, be regarded as a measure of its permeability to ions.

In Laminaria the protoplasmic masses (cells) are separated from each other by a thin layer or gelatinous substance (cell wall). In passing through the

tissue a part of the current goes through the protoplasm, and another part passes between the protoplasmic masses in the substance of the cell wall. Consequently, in employing the electrical method it must be ascertained whether the permeability of the protoplasm or that of the cell wall is being investigated.

Obviously the best method of attacking this problem is to kill the tissue by such means (partial drying, heating to 35° C., weak alcohol, etc.) as can not alter the cell wall, and then investigate its behavior under the influence of various reagents. All of these methods produce the same result. After death the tissue no longer shows the changes in resistance which are observed when living tissue is subjected to the influence of reagents. It is, therefore, evident that the changes are due to the living protoplasm.

Experiments show that the resistance of the living tissue is much greater than that of tissue which has been carefully killed with all possible precautions to prevent any alteration of the cell wall. It is concluded, therefore, that the conductivity of the living protoplasm is less than that of the cell wall. All the experiments hitherto made indicate that the conductivity of the cell wall remains unaltered in spite of changes in the chemical character of the solution, provided the conductivity of the solution remains the same.

Summarizing the results of experimentation, the author states that an electrical current passing through a living plant flows partly through the cell wall and partly through the protoplasm, and the relative amounts of these two portions of the current can be calculated. The outcome of such calculation shows that the conclusions drawn from the study of the resistance of the tissue as a whole apply also to the resistance of the protoplasm, and consequently to the permeability of the protoplasm to ions.

The effect of peat on the transpiration and growth of certain plants, K. M. THATCHER (*Jour. Ecology*, 9 (1921), No. 1, pp. 39-59, figs. 6).—Transpiration data were obtained by weighing rooted plants grown in peat and loam soils or solutions from such soils, several plants being used in each type of medium and the average transpiration in different media compared. A comparison between the average relative transpiration of the groups of plants in the different media was also made.

The chief factors influencing relative transpiration of the plants were found to be the evaporating power of the air, the moisture content of the soil, the type of the soil, and the healthy or unhealthy development of the roots.

Stimulating action of nitrogenous salts on the germination of *Amaranthus caudatus*, E. C. VAN DEN BOS (*Rec Trav. Bot. Neerland.* 17 (1920), No. 1-2, pp. 69-128).—It is stated that at temperatures of 15 to 20° C. (59 to 68° F.) seeds of *A. caudatus* germinate in darkness only. At temperatures successively higher germination occurs increasingly until a point is reached at which light and darkness are equally favorable to germination. At 43 to 45° these seeds germinate in light only. Plantlets so produced, however, never attain complete development.

Light may retard or inhibit germination both directly and by some after effect, the nature of which is not yet apparent. The inhibiting action of light may be neutralized by various nitrates as well as by potassium sulphocyanate if not used in too high percentages, the last-named substance appearing to have, in case of *A. caudatus*, a direct stimulating effect on the embryo itself. In order to make this effective, the seeds should be steeped for 48 hours in a solution of 0.4 gm. molecular concentration. Among the nonorganic substances tested, nitric acid alone showed a stimulating action on germination.

Salt effects in bacterial growth. —I, Preliminary paper, G. E. HOLM and J. M. SHERMAN (*Jour. Bact.*, 6 (1921), No. 6, pp. 511-519).—It is claimed that the growth of *Bacterium coli* in 1 per cent peptone medium is accelerated or retarded by different salts in low molecular concentrations. The salt effects at various H-ion concentrations vary greatly. Salts which accelerate growth seem to widen the H-ion range for optimal growth, while those which retard growth seem to narrow the limits of optimal activity. Cations and anions are both effective.

Types of mutations and their possible significance in evolution, A. F. BLAKESLEE (*Amer. Nat.*, 55 (1921) No. 638, pp. 254-267).—In view of the growing belief that most of the new forms which have appeared in cultures of the *Oenotheras* are not mutations at all, and that the evening primroses, as an abnormal group of plants, are not to be seriously considered as representative of the processes of evolution in normal forms, the author outlines, with discussion, some recent findings in studies on the jimson weed (*Datura stramonium*). These, it is hoped, may incidentally throw some light on the more highly involved phenomena in the *Oenotheras*, and may serve as the basis of a brief discussion of their possible evolutionary significance. The author attempts to make clear and to emphasize the distinction which should be kept in mind in any discussion of the subject between mutations in individual genes and those brought about by chromosomal aberrations.

Note on the evolution of the double stock (*Matthiola incana*), E. R. SAUNDERS (*Jour. Genetics*, 11 (1921), No. 1, pp. 69-74, figs. 3).—Examination of evidence available regarding the developmental or mutational origin of full doubleness in *M. incana* is thought to justify the conclusion that there is no case on record of a genuine semidouble stock. The records in question apparently owe their origin to the occasional occurrence of more or less perfect twinning of the lowest flowers on the earliest flowering axes.

Studies of inheritance in the Japanese *Convolvulus*, H. B. MIYAZAWA (*Jour. Genetics*, 11 (1921), No. 1, pp. 1-15, pl. 1). In an article previously noted (E. S. R., 40, p. 541) the author stated that yellow plants never bear dark-red flowers, but since that time he has obtained a yellow-leaved race producing such dark-red flowers. Having conducted hybridization experiments between such race and each of the two original parents, he presents the results of these experiments in the present paper, which also gives some details of experimentation only very briefly indicated in the previous paper.

A study of the segregation of a quantitative character in a cross between a pure line of beans and a mutant from it, I. LARSEN (*Jour. Genetics*, 11 (1921), No. 2, pp. 183-204, pl. 1, figs. 3).—The data and discussion here presented represent the outcome of quantitative studies applied to characters developed by the progeny of 60 bean seeds furnished by W. Johannsen after selection as suitable for measurement singly with apparatus said to have been described by him in his book, previously noted (E. S. R., 21, p. 771). No essential difference is seen between the problem of qualitative and quantitative differences, the value of the latter of these two kinds of characters being regarded as established by the work of Johannsen, Jennings, and others, and as thus paralleling the work of Mendel and his followers employing purely qualitative characters.

A graft-infectious disease of *Datura* resembling a vegetative mutation, A. F. BLAKESLEE (*Jour. Genetics*, 11 (1921), No. 1, pp. 17-36, pls. 5).—In 1915 a plant of *Datura* was discovered showing certain exceptional characters supposedly setting this form apart as a mutation but, as afterwards discovered, really manifesting a form of disease, transmissible by grafting upon normal stock. The supposed mutant was designated as *quercina*, on account of leaf

characters described, though the most conspicuous of the peculiarities displayed is the suppression of the spines on the capsule, which may be as complete as in the variety *inermis*. The condition breaks out in the field, generally appearing late, on plants of normal parentage.

Studies, with resulting data, are noted as carried out under the supposition that this form was a mutation. The *quercina* character (-group) generally shows itself first weakly in a single branch, gradually spreading to all the new growth. The *quercina* complex is transmitted by seed to about 79 per cent of its offspring when pollination from normal plants occurs, the remaining 21 per cent producing no *quercina* seedlings in the next generation. A rough correspondence appears between the strength of the *quercina* character in the parent and the number of *quercina* plants in the offspring. *Quercina* scions grafted on to Jimson weed caused the new growth of the stock to show the *quercina* characters, the cause of which is definitely stated to be a disease transmissible by grafting. Certain others of the Solanaceae are susceptible in less degree to such graft infection. Rubbing with leaves or inoculating with juice of diseased plants did not infect sound plants. Another disease of Jimson weed is described as being highly infectious by contact.

An apparent case of non-Mendelian inheritance in *Datura* due to a disease. A. F. BAKERELL (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 4, pp. 116-118). - A somewhat briefer account than that above noted is given of the observations on *quercina* plants by the author and by others who have found such plants in their cultures when working with *D. stramonium*.

Though *quercina* flowers are characteristically devoid of pollen, a few plants which were developing the *quercina* character group yielded pollen, which was used in crosses with normal plants. These gave rise to *quercina* offspring, showing that the character-group can be transmitted through the male.

The profound morphological changes brought about in the leaves and especially in the flowers and fruits are such that *quercina* individuals would be considered worthy of specific if not of generic separation if 100 per cent of the seedlings instead of only 75 per cent came true to the *quercina* complex. As the fact stands, however, there is much in the behavior of the *quercina* plants which suggests genetic phenomena.

Degeneration and regeneration in potato. V. PEGLION (*Italia Agr.*, 58 (1921), No. 12, pp. 357-365, *figs.* 8). - Systematic presentation is given of information from sources indicated.

Root cuttings and chimeras. H. W. BATESON (*Jour. Genetics*, 11 (1921), No. 1, pp. 91-97, *pls.* 2). - Details are given of further studies on Bouvardia (E. S. R., 37, p. 434) and derivatives, also on Pelargoniums (with notes supplied by D. M. Cayley).

In the discussion of root cuttings previously noted, the author treated the dissimilar forms which arise as being probably included in the form of "cores" within a cortex of the ostensible type. The plant as a whole was thus regarded as a periclinal chimera, one variety inclosing another, and this inclosed form being liable to come out whenever the plant makes an adventitious bud by endogenous growth. Though this view is presumably correct in some cases, the distribution seen in the variegated plants here referred to is considered to show that other possibilities must be reckoned with, as in such plants the white tissue is not covered in but extends throughout the whole of the internodes and doubtless the root also. The growing point alone carries up with it the capacity to form green tissue. Other features and inferences are discussed.

Some aspects of botany in South Africa and plant ecology in Natal. J. W. BEWS (*So. African Jour. Sci.*, 18 (1921), No. 1-2, pp. 63-80). - A review

is given of the development of botany in South Africa, with sections referring more particularly to Natal as regards plant ecology, its main botanical regions and plant communities, plant migration and the affinities of the Natal flora, life forms, and plant successions.

The aquatic vegetation of the English lakes, W. H. PEARSALE (*Jour. Ecology*, 8 (1920), No. 3, pp. 163-201, figs. 13).—The evidence here presented from the study of the aquatic plant communities of the English lakes is considered to justify certain general conclusions for this lake area.

The distribution of the aquatic plants considered is governed primarily by the nature of the substratum, while the reaction of the substratum to vegetation is controlled by variations in the quality and quantity of sediments deposited on it and by the type and quantity of organic matter it contains. Light intensity may limit the depth to which types of vegetation descend, but is of secondary importance in the distribution of most of the plants. Temperature conditions appear to retard the development of vegetation during early summer, but to be of little significance in other respects. The absence of free floating vegetation is attributed to a scantness of essential plant foods. Plant succession is accompanied by changes in the substratum related to those resulting in the formation of moor peat.

The significance of the calciculous habit, E. J. SALISBURY (*Jour. Ecology*, 8 (1920), No. 3, pp. 202-215).—The results of an examination, largely bibliographical (59 titles), led to the conclusion that the solution of the problem of calcicoly is probably not to be found in one factor but perhaps in many, though possibly all are comprised in the two main groups (physical or chemical in nature) suggested.

Chart of the families and genera of the bacteria, H. MACY (*Jour. Bact.*, 6 (1921), No. 6, pp. 575, 576).—The final report, previously noted (*E. S. R.*, 44, p. 517), of the committee on characterization and classification of bacterial types, of the Society of American Bacteriologists (offering a tentative outline of bacterial classification), having suggested to the author the idea of preparing a chart to illustrate graphically the positions of the orders, families, tribes, and genera of bacteria, such a chart is accordingly presented.

Violets of North America, E. BRAINERD (*Vermont Sta. Bul.* 22½ (1921), pp. 3-172, pls. 25, figs. 65).—This monograph, illustrated in part in color and in part by line drawings, presents data relative to the habitat, history, and distinguishing botanical characters of 75 species of North American violets, several of which were originally classified and named by the author. Of a total of 984 hybrids contained in the author's herbaria, 89 distinct forms are enumerated in connection with brief information relating to the source of material and previous literature.

A list of 25 contributions by the author to the literature of *Viola* is appended. The introduction, concerning the purpose and scope of the investigation, is by G. P. Burns.

FIELD CROPS.

Report of [field crops] work at Fairbanks Station, M. D. SNODGRASS (*Alaska Stas. Rpt.* 1920, pp. 38-44, fig. 1).—In a season reported as the most unfavorable in the history of farming in the Tanana Valley, wheat yields among farmers ranged from 5 to 25 bu. an acre, averaging 15 bu. Potato land sowed to wheat for the first or second time produced from 20 to 25 bu.

Investigations with cereals were in continuation of work noted previously (*E. S. R.*, 44, p. 522). Hansen oats with 37.5 bu. per acre led 15 oats varieties, which averaged 29 bu. Hybrid barleys from the Rampart Station are con-

sidered superior to any varieties of barley from the States. Notes on buckwheat, peas, red clover, grain hay, and root crops are included.

The yields of grain grown on pea and potato land were about double those secured on grain land. Results from a 4-year rotation of red clover, oats, potatoes, and wheat indicated that clover draws too heavily upon the soil moisture to be followed by a grain crop. Apparently, grain can not be grown continuously on south hillside land or thawed land without depleting the soil moisture.

Gold Coin, Bliss Triumph, and Extra Early Pioneer gave the highest yields of the potato varieties, with 102.7, 98.5, and 98.4 bu. per acre, respectively. Beauty of Hebron, Extra Early Pioneer, and Burpee Superior came up from two to four days earlier than other varieties, regardless of the date of planting.

Hansen Sempalatinsk seems the hardiest of the alfalfas, but is considered less desirable in foliage production.

Report of [field crops] work at Kodiak Station, W. T. WHITE (*Alaska Stas. Rpt. 1920, pp. 59, 60*)—A continuation of earlier trials of hay and silage crops (E. S. R., 44, p. 522) is reported.

Although oats and peas made heavier yields of silage than either oats and vetch, barley and peas, or barley alone, none of the crops had reached the desired state of maturity when frost necessitated cutting. Oats alone produced the greatest growth at Kalsin Bay, and oats and peas ranked next.

Report of [field crops] work at Matanuska Station, F. E. RADER (*Alaska Stas. Rpt. 1920, pp. 52-57, pl. 1*). Field notes are recorded as heretofore (E. S. R., 44, p. 523) on varieties of barley, wheat, oats, sunflowers, and winter rye, and trials of grasses, clovers, and alfalfas are described. Sunflowers were again killed by frost when the best stalks reached a height of 6 ft. and were beginning to form heads. About 60 per cent of the plants of Grimm alfalfa, all common and Turkestan alfalfa, and 50 per cent of white clover seeded in 1919, and most of the red clover plants were winterkilled. White Bliss continued to be the leading potato variety. Outstanding among root crops were Yellow globe mangels with 10.25 tons per acre, Giant Feeding sugar beet with 8.75 tons, and Mastodon carrot 10.75 tons.

Report of [field crops] work at Rampart Station, G. W. GASSER (*Alaska Stas. Rpt. 1920, pp. 22-31, 32, 33, figs. 2*)—Observations on varieties and hybrids of winter and spring wheat, and rye, oats, and barley, and plat tests of hemp, flax, and buckwheat are recorded as heretofore (E. S. R., 44, p. 521).

Medicago falcata survived the winter as in previous years, but matured very little seed. Trials of *Trifolium lupinaster*, *T. pratense*, *Vicia cracca*, and Grimm alfalfa are noted briefly.

In a cooking test of potato varieties where Irish Cobbler was rated 100, other varieties graded as follows: Alaska Beauty, 100; Clark Seedling, Red River Irish Cobbler, Red River Triumph, and Gold Coin, 95; Green Mountain, Roosevelt, Red River Early Ohio, New Queen, and White Star, 90; Pioneer, 85; Carman No. 1, Early Six Weeks, and Noroton Beauty, 80; Bliss Triumph, Improved Peerless, White Plume, and Olds Select Rural, 75; and Mammoth Pearl, 70.

[Report of field crops work in North Carolina, 1920-21], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1921 pp. 24-33, 35-38*).—Further progress of experimental work, noted previously (E. S. R., 45, p. 430), is reported.

Tobacco showed striking superiority on freshly cleared hardwood land as compared with old land at Reidsville, whereas corn was much better on old land. Benefit was derived from applications of both lime and phosphoric acid by both corn and tobacco, and tobacco grown continuously was markedly superior to tobacco alternating with corn. On plats where muriate of potash,

kainit, and manure salts were applied, the growth of the tobacco was noticeably better than that on plats receiving sulphate of potash.

At Oxford, with the omission of potash, leaf spot rendered tobacco practically worthless. Dolomitic limestone increased the yield on practically all plats without lowering quality. Muriate of potash gave a larger yield of tobacco with equal market value to that grown from sulphate of potash although the too extensive use of muriate is said to injure the burning quality. In rotation tests, tobacco after a green manure of cowpeas, with increased potash and phosphoric acid, but without commercial nitrogen, produced from 800 to 1,100 lbs. per acre of leaf of average good quality. The use of dolomitic limestone containing from 20 to 35 per cent of magnesium carbonate was found to be a practical and inexpensive method of preventing "sand-drown." Continuous cropping with tobacco was found dangerous, especially where tobacco wilt is prevalent.

Fertilizer tests with corn on mountain soils suggest for bottom-land soils (Toxaway loam) the use of at least 600 lbs. per acre of fertilizer containing 10 per cent of phosphoric acid, 1.5 to 2 per cent of nitrogen, and 1 per cent of potash. On upland soils (Porter's loam) the application of from 400 to 600 lbs. of fertilizer containing 10 per cent of phosphoric acid, 2 per cent of nitrogen, and 1 per cent of potash is recommended. Plowing in leguminous crops and crop residues is advised as a means to reduce the nitrogen in the fertilizer. Lime alone was profitable, but much greater profits accrued when lime was applied with a complete fertilizer.

Cotton on plats at Iredeell farm receiving heavy applications of lime and with high percentages of acid phosphate in a complete fertilizer, applied at planting time on a clover sod, shed its bolls least and opened early. Different strains isolated from King cotton showed considerable variation in width of fiber and number of twists per inch. A positive correlation was found between broad fiber and high tensile strength. The largest number of twists per inch was observed to be associated with the narrowest fibers. Microscopic studies revealed that a variety recommended by manufacturers because of excellent body and spinning quality had greater breadth of fiber, fewer twists per inch, and greater strength than King, Cleveland, or Cook. Eight-inch spacing has returned the highest yield of seed cotton and lint per acre.

Seed improvement work with corn, cotton, soy beans, wheat, and rye is described briefly. Western grown Kanred showed much higher rust resistance, but its yield was considerably less than local varieties of wheat, and while North Carolina grown Kanred made a relatively better standing, its yield was almost doubled by an early strain of Purple Straw.

[**Field crops work in Washington**], E. G. SCHAFER, O. M. MORRIS, F. J. STEVENS, M. A. McCALL, C. E. HILL, and R. P. BEAN (*Washington Col. Sta. Bul.* 167 (1922), pp. 28, 29, 35, 36, 45, 49, 51, 52, 57).—The average acre yield of leading field crop varieties at the station from 1914 to 1920, inclusive, were Hybrid 128 winter wheat 43.3 bu., Bluestem spring wheat 40.1, Banner oats 88.7, White Winter barley 55.3, Beldi spring barley 68.2, Yellow rye 28.3, Bangalla field peas 30.5, and Minnesota 25 flax 11.8 bu. Turkey Red winter wheat and Early Baart spring wheat, varieties predominating in areas with less than 16 in. rainfall, averaged 38.9 and 35.6 bu., respectively.

Strain tests with seed potatoes from several localities are noted, showing a range in productivity from 3,764 to 13,952 lbs. per acre. The indications are that superior producing material in one locality will also show that same characteristic when planted in another district in different soil and climatic environments.

More grain was obtained with wheat alone than with any combination of wheat, oats, barley, and peas seeded together. Wheat produced after vetch or peas as green manure equaled in yield and quality the wheat on good summer fallow, but for immediate production, green manuring is not considered economical. Harrowing winter wheat in the spring did not produce consistent advantages at the Adams Substation and resulted in yields from 1 to 2 bu. less than on ground not harrowed at the Waterville Substation. At Waterville, winter wheat has given the best results for hay, silage, and grain.

Where small grain nurse crops were failures, peas were used very successfully for both red and sweet clover, even when the peas were harvested for seed and produced from 30.3 to 25.7 bu. per acre. Yield differences were not obtained where phosphorus and potassium fertilizers and lime were used separately and in combination on alfalfa. Gypsum produced no increase when applied to small grain, whereas it not only increased the yield of alfalfa and red clover but produced hay of higher nitrogen content. Alfalfa cut up to one-fourth in bloom, when one-half in bloom, and in three-fourths to full bloom at the Irrigation Substation made total yields of 6.8, 7.5 and 8 tons per acre, respectively, for three cuttings.

The phylogeny of the cereals, E. SCHIMMANN (*Naturwissenschaften*, 10 (1922), No. 6, pp. 133-140).—A critical review of the different means of tracing the origin of cereals. Positive results have been obtained with wheat and oats but little is known concerning barley. Rye and other allogamous plants present different aspects and are treated only briefly.

The historical and philological methods are held limited in application to tracing the migration of cultivated plants. The plant-geographical method has been employed with oats and rye and in locating new wild forms of wheat and barley. The descriptive morphological method evidently applies to the large group classifications of all cereals. Differentiation must be made between original and acquired characters in order to evaluate convergence phenomena. The serological method has proved good with oats, uncertain with barley, and clearly better for the differentiation of varieties than for species. The method involving ability to hybridize is uncertain with wheat, denied with barley, and little tried with oats. Experimental hybridization is considered an important analytical method with regard to new cross forms, reversion, mutations, and monstrosities.

Alfalfa culture in North America, H. WYTH (*Blauzernodlingen i Nordamerika*, Stockholm: Sveriges Allmänna Landtbr. Sällsk. Föreläsakt., 1921, pp. 117, figs. 54).—This is a report dealing mainly with a description of the culture and uses of alfalfa in the United States and Canada as observed on a tour of study made in the summer of 1919 under the auspices of the Royal Agricultural Academy of Sweden. Conditions of soil and climate and farm practices relating to alfalfa culture are discussed, and a general review of results of experiments with alfalfa secured by different experiment stations is included. In addition the possibility and advisability of extending alfalfa culture in Sweden is considered. A list of 316 references to literature relating to alfalfa culture in North America is given.

Desirable qualities of California barley for export, J. W. GILMORE and L. J. FLETCHER (*California Sta. Circ.* 246 (1922), pp. 11, fig. 1).—Barley for export should be reasonably free from injury, plump, bright, and viable. This circular discusses thresher damage and its prevention, protein content, color, plumpness, and uniformity and purity of sample. Barley standards, promulgated by the California Department of Agriculture on May 10, 1922, are appended.

The potassium-nitrogen ratio of red clover as influenced by potassic fertilizers, P. EMERSON and J. BARTON (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 182-192).—Pot culture tests at the Iowa State College on the effects of applications of various forms of fertilizers upon the amounts of potassium and nitrogen on red clover plants grown on a Miami silt loam soil led to conclusions which may be stated as follows:

The amount of potassium taken up by red clover from a soil varies with the treatment applied. The solubility of soil potassium, as indicated by the percentage taken up by the plant, is increased by applications of manure and of acid phosphate, or of combinations of both. The ability of red clover to take up potassium also varies with the compound supplied. Potassium is taken up in the smallest amounts from potassium chlorid and in larger amounts from potassium sulphate, while under some conditions the potassium in kainit may be taken up entirely.

Applications of lime in the form of calcium carbonate to an acid soil apparently have no effect on the solubility of native soil potassium, but may possibly overstimulate nitrate production. The potassium-nitrogen ratio is widened slightly by applications of lime, but is narrowed by applications of manure or acid phosphate, or both, in the presence of lime.

The effect of fertilizers on yield and market condition of corn, W. B. ELLETT and T. K. WOLFE (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 5, pp. 153-158).—Data presented at the Virginia Experiment Station, from 4-year rotations, continuous cropping, and green manuring experiments, including corn and various applications of fertilizers, indicate strikingly that the materials which increased the yields of corn, i. e., phosphates and stable manure, also increased the percentage of marketable grain. The same materials have been found (E. S. R., 44, p. 626) to increase the yield of wheat and to reduce the injury from winterkilling and the Hessian fly.

Svalöf Orion oats, Å. ÅKERMAN (*Sveriges Utsädesför. Tidskr.*, 32 (1922), No. 1, pp. 4-20, figs. 2).—Orion oats, a new early black oats variety originated at Svalöf, is described, and the results of comparative tests with this variety and others of similar origin and value, conducted for a series of years in different parts of Sweden, are reported.

In a 4 year test ending in 1920 Orion oats on the average headed in 53 days and ripened in 88 days from the time of seeding, standing next to the earliest variety of the six under comparison. Germination tests made for three successive years in two localities showed that Orion ranked high in germinative ability among nine varieties compared. In the weight and quality of grain, based on the percentage of hull, Orion stood slightly under the other varieties in the test. In yielding capacity the variety stood among the leading half of the number of varieties in the tests carried on in two different localities for three and four years, respectively. On the basis of these results it is concluded that Orion oats is a valuable addition to the varieties grown in Sweden and that it is well adapted to certain northern localities.

Phormium tenax: The New Zealand fiber industry, E. H. ATKINSON (*New Zeal Jour. Agr.*, 22 (1921), Nos. 2, pp. 81-86; 4, pp. 203-216; 5, pp. 283-289; 6, pp. 347-356; 23 (1921), Nos. 2, pp. 103-107; 5, pp. 298-302, figs. 28).—A concise account of the production of *P. tenax* in New Zealand, with chapters on the development of the industry; botanical characteristics of the plant; fiber extraction and milling; grading, marketing, and uses; and diseases and insect pests.

[Work with potatoes at the Sitka Station], C. C. GEORGESON (*Alaska Stas. Rpt.* 1920, p. 19).—Trials of potato varieties and seedlings are described as heretofore (E. S. R., 44, p. 528).

The effect of different applications of artificial fertilizers on improved and unimproved potatoes, L. HILTNER and F. LANG (*Landw. Jahrb. Bayern, 11 (1921), No. 4-5, pp. 259-272*).—On a humus shot-clay soil, basic amounts of 60 kg. of phosphoric acid, 100 kg. of potash, and 30 kg. of nitrogen, per hectare (53.4, 89, and 26.7 lbs. per acre, respectively) and double and triple these amounts were applied in 1914 to Alte Regensburger, an unimproved potato variety, and to Jubel from newly improved seed and from seed grown commercially for some time. Similar applications were made in 1919 and 1920 on new Parnassia seed, commercialized Parnassia, and Erdinger, an ordinary variety, with the basic phosphoric acid reduced to 45 kg. and the potash to 60 kg.

On untreated plots the longer-grown improved varieties averaged the highest in yield and the unimproved seed the lowest. Even with the heaviest fertilization the unimproved seed did not equal the yields that the others made without fertilizer. Tuber production was proportional to the increase in fertilizer application. The yields of the new improved stock averaged higher than the older improved stock, increasing with the successive fertilizer applications and greatly exceeding those from commercial seed. The improved seed, not yet commercialized, also gave a high net profit.

The influence of overfertilization on the yield and development of potatoes, L. HILTNER and F. LANG (*Landw. Jahrb. Bayern, 11 (1921), No. 4-5, pp. 273-308*). Applications of 80 kg. of phosphoric acid, 140 kg. of potash, and 60 kg. of nitrogen per hectare, and 3 and 4 times these amounts, alone and in combination, were made to Wohltmann potatoes on a humus shot clay soil.

While very strong applications of fertilizer gave profitable yields with the variety and soil employed, they influenced the seed value of the harvested tubers very unfavorably. With this particular variety and soil, and probably with similar varieties and soils, extraordinarily high tuber yield and clear gain could be expected with the use of recently bred seed from a good potato soil and very high fertilizer applications. However, it is felt that such overfertilization can only result in restricting the yield of the seed stock and lead to exhaustion when continually practiced in the same area. This unfavorable condition could be greatly mitigated by the use of stable manure and green manures.

Potato spraying [experiments in North Carolina], Z. P. MELCALF (*North Carolina Sta. Rpt. 1921, pp. 52, 53*).—In tests conducted at the Buncombe Substation in 1921 to determine the value of different spray mixtures for the control of insects and fungus pests on the Irish potato, all the materials used had a favorable influence on yield.

In comparing two Bordeaux-arsenate sprays, one of which contained 4 lbs. of copper sulphate and 5 lbs. of lime and the other 3 and 4 lbs. of the same materials, the stronger mixture gave the larger yield, 158 bu. per acre as compared with 151 for the weaker mixture and 95 for the check area. The materials were hand applied and used five times.

A comparison on a different area, of hand spraying with machine spraying, in which the same materials were used but with a different number of applications (four with hand and five with machine) showed the greater gain in yield in favor of hand spraying. The yields were as follows: Check 125 bu., machine sprayed area 140 bu., and hand sprayed area 154 bu. per acre. A comparable area sprayed with arsenate of lead alone yielded at the rate of 132 bu., leading the author to suggest that arsenate of lead does not equal Bordeaux mixture in promoting yield.

Influence of fertilizers on yield and maturity of soy beans, G. L. SCHUSTER (*Jour. Amer. Soc. Agron., 14 (1922), No. 5, pp. 193-197*).—The aver-

age of six years' yields of soy beans grown in a rotation on a Sassafras soil and receiving applications of nitrate of soda, phosphates, and muriate of potash, alone and in combination, and manure are reported in this contribution from the Delaware Experiment Station.

The data presented show that the highest yield is closely correlated with the highest test weight of the harvested crop, and that the number of immature beans per 100 gm. gradually increases as the yield decreases. There was a marked increase in the quantity of immature beans and a marked decrease in yield from the plats where muriate of potash was omitted. Substantiating the observations of Lipman and Blair (E. S. R., 41, p. 23), muriate of potash in combination has produced better results than where used alone. Heavy applications of manure (5 tons per acre) gave the best results as to yield and maturity. In the absence of manure, applications of 250 lbs. of acid phosphate and 75 lbs. of muriate of potash are recommended. With the advent of lower prices, more potash should be used. Nitrate of soda does not seem to produce desirable results with soy beans either as to maturity, yield, or financial returns.

Experiments with sugar beets in Italy. J. DE VILMORIN (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 3, pp. 66-73; *abridged in Jour. Agr. Prat.*, n. ser., 37 (1922), No. 4, pp. 84, 85). This is a report of experiments with sugar beets made by O. Munerati at Rovigo, Italy, with conclusions which can be summarized as follows:

The salts of manganese and aluminum, boric acid, and borax were negligible in their effect on the yields of beets, unfertilized plats giving yields equal to treated plats. Three types of roots were noted in the second-year seed beets, those retaining nearly completely their form and weight but with very little or no sugar, those changing shape and adding weight by new peripheral forms and with a notable increase in sugar, and intermediate types.

An exact relation was not found between the spacing of the plant and the weight the beet could attain. The beets in wide spacing averaged larger, but large beets were also found with narrow spacing and very small beets in large spacing. The weather conditions in successive seasons can vary weights enormously. The idea of cultivating either sugar or forage beets in wide distances to obtain large size is considered valueless from both technical and practical standpoints. Forage beets, even of large size, mixed with sugar beets do not prevent the normal development of the latter.

Defoliated beets are always poor in sugar, the increase in sugar is stopped by stripping off the leaves, and production of new leaves is made at the expense of the sugar contained in the root. The differences in the form, weight, and sugar content of plants originating from the same glomerule are deemed of more or less importance. The variations suggest that a beet glomerule is normally a family comprising individuals with but slight homogeneity, a phenomena traceable to cross-fertilization.

The sugar industry in its first century, 1821-1921. E. J. SCHLEH (*La Industria Azucarera en su Primer Centenario, 1821-1921*. Buenos Aires: Ferrari Bros., 1921, pp. 447, pls. 25).—A comprehensive account of the sugar industry in Argentina, considering the introduction and dissemination of the crop, the development of the industry in Tucuman, the sugar regions of the Republic, refineries, the alcohol industry, institutions furthering the sugar industry, cultural methods and field practices with sugar cane, cane growers' associations, methods of sugar manufacture, production, consumption, and commercial movement of sugar, sugar legislation, status of the sugar industry in producing countries, and the future of the sugar industry in Argentina.

The indeterminate growth factor in tobacco and its effect upon development. D. F. JONES (*Genetics*, 6 (1921), No. 5, pp. 433-444, figs. 5).—Crosses between the indeterminate mutant and the original type of Cuban tobacco, descendants of the material described by Hayes and Reinhart (E. S. R., 31, p. 43), were studied at the Connecticut State Station. The occurrence of this aberrant form in many agricultural varieties and its behavior has been described also by Allard (E. S. R., 41, p. 140).

"The hybrid between the mutant and the original stock, which upon fairly good evidence is heterozygous in only a single factor, differs in an appreciable manner from either parent. Normal growth and reproductive processes are dominant, but the intermediate nature of the hybrid delays the time of flowering and permits a larger growth and therefore greater reproduction capacity. In a short-season environment the later maturity would be a disadvantage but otherwise the hybrid is superior to either parent in size and ability to produce seed. . . . The haploid condition may in particular instances, be advantageous even on a purely inheritance basis, and this fact must be taken into consideration in comparing heterozygous and homozygous combinations"

Svalöf Rubin spring wheat, Å. ÅKERMAN (*Svenskes Utsädesfor. Tidskr.*, 32 (1922), No. 1, pp. 48-59).—This variety, a cross between the Dala and Kolben spring wheat varieties, is described as an early spring wheat adapted to the climatic conditions of middle Sweden. The results with reference to growing period, quality, and yielding capacity, as indicated in comparative tests with other new and standard varieties of spring wheat, are given in tables and discussed.

As shown by the results of tests, the growing period of Rubin was about the same as that of Dala, while the yielding capacity seemed somewhat higher. In straw production the new variety stood comparatively low, while in rust resistance it was intermediate between the parent sorts. The average bushel weight in experiments in progress at Ultuna from 1916 to 1921 was 57.8 lbs. for Rubin, 57.1 lbs. for Kolben, and 57 lbs. for Dala. From these and the results of a number of other local experiments it was concluded that Rubin spring wheat is a variety of value for middle Sweden and for the higher altitudes of the interior regions of the southern part of the country.

Wheat growing after fallow in eastern Oregon, D. E. STEPHENS and G. R. HYSLOP (*Oregon Sta. Bul.* 190 (1922), pp. 35, figs. 13).—About 1,250,000 acres are annually devoted to wheat in the 18 counties east of the Cascade Mountains in Oregon. Wheat is grown principally after summer fallow, and the area seeded, excluding that summer fallowed, about equals the acreage of all other cereals and forage crops combined. Cultural direction based on experiments at the Moro Substation (E. S. R., 44, p. 826) are given.

Spring disking before late spring plowing killed weeds, saved moisture, and increased yields, whereas spring disking before early spring plowing did not pay. Burning stubble is not advised. The highest yields and best quality of wheat were produced on early-spring-plowed summer fallow. Winter wheat after early spring plowing averaged 6.3 bu. more per acre than after late spring plowing, and 2.3 bu. more than after medium early spring plowing. Fall plowing and medium early spring plowing for summer fallow gave similar yields, while late spring plowing for fallow produced low yields and soft wheat. Ten-in. plowing averaged only 0.9 bu. per acre more than 5-in. plowing. Moldboard plowing in the fall gave slightly higher yields of winter wheat than disk plowing. The use of the subsurface packer did not increase yields, and the surface packer gave only slight increases. The 9-year average yield of winter wheat was reduced 1 bu. per acre by spring harrowing.

Early seeding of from 4 to 5 pk. of treated winter wheat per acre gave the highest yields at Moro. Large-kerneled varieties, like Early Baart, should be seeded thicker.

The highest yielding winter wheats, Kharkof, Argentine, Turkey 1571, Hybrid 123, and Hybrid 128, and other winter and spring wheat varieties are described briefly. Early Baart, Hard Federation, and Federation spring wheats have practically replaced Pacific Bluestem in eastern Oregon, and with an increase in yield of from 20 to 30 per cent. A wheat survey in eastern Oregon showed a total of 41 varieties grown commercially, which could profitably be reduced to not over seven.

Winter wheat outyielded spring wheat but did not equal the latter in milling quality. Kharkof was the best milling winter-wheat variety. Milling and baking tests are reported, from which Hard Federation, Federation, and Early Baart are indicated as good milling spring wheats.

Washington's new seed law, H. BEBB (*Seed World*, 11 (1922), No. 10, pp. 38, 40).—A summary of the seed law of the State of Washington, as amended in 1921, with comment.

HORTICULTURE.

[**Horticultural investigations in Alaska**], C. C. GEORGEFSON, G. W. GASSER, M. D. SNODGRASS, and F. E. RADER (*Alaska Stas Rpt. 1920*, pp. 13-19, 20, 31, 32, 33-36, 45, 57, 58, 63-66, *figs. 3*)—In conformity with those of previous years (E. S. R., 44, p. 531), this report contains information relative to various fruits, vegetables and ornamentals under test at the Sitka and other stations. Brief reports from settlers and other parties concerning the behavior of seeds and plants distributed in the past by the stations are also included.

In strawberry breeding investigations conducted at the Sitka Station, two native species, *Fragaria chiloensis* of the coast region and *F. platypetala* from the interior, have been used with marked success as pollen parents in various crosses. The pollination of Hollis, a comparatively hardy variety, with *F. chiloensis* resulted in many promising varieties, some of which were propagated on account of hardiness and excellent flavor. Unfortunately, these particular seedlings lacked in firmness of berry and bright red color. Additional crosses involving the use of these hybrids, imported varieties, and *F. platypetala* have yielded strawberries of superior merit, which have been distributed to the other stations for trial and propagation. In all, the Sitka Station has produced and tested approximately 12,000 seedling strawberries.

Among many raspberries tested at the Sitka Station, the Cuthbert has proved the best variety for the coastal region, being a free grower and a prolific bearer of large, well-flavored berries. Many of the better known varieties of red, white, and black currants are grown successfully. The gooseberry has also proved well adapted to this region.

Among the progeny of a cross between the Cuthbert raspberry and the native salmonberry (*Rubus spectabilis*), one plant was found to be exceptionally worthy of propagation and was named the Bensonberry. This hybrid form resembles both parents and bears fruit of good flavor, light-yellow color, and of fair size, but unfortunately is lacking in general vigor.

Among 40 varieties of apples tested during a period of 12 years, only 2, Yellow Transparent and Livland Raspberry, have proved satisfactory. In some seasons the fruit of Yellow Transparent compares favorably with that grown in the States. None of the cherries, either sweet or sour, have proved adapted to Alaskan conditions. The Early Richmond, however, has in some seasons set fruit. Pears also have been found to be unsuited to the environment.

Although many of the more desirable ornamental plants, including lilac, bush honeysuckle, Cotoneaster, mock orange, and *Rosa rugosa*, are hardy on the coast, only one, *R. rugosa*, is able to withstand the winters of the interior districts where, because of its beauty and hardiness, it is highly esteemed. Annuals, bulbous plants, and various house plants may, with proper care, be grown successfully. Practically all the half-hardy vegetables, cabbage, cauliflower, turnip, peas, celery, etc. are grown with success. The greenhouse operations although materially handicapped by the almost continual cloudiness prevailing during the winter season, have not been without avail, chrysanthemums, cinerarias, and calceolarias being grown satisfactorily.

Data are presented on the behavior of various vegetables, small fruits, and flowers at the Rampart, Fairbanks, and Matanuska Stations.

Report of the division of horticulture [North Carolina], C. D. MATTHEWS ET AL. (*North Carolina Sta. Rpt. 1921, pp. 60-66*).—The activities of the year, under various project headings, are briefly reviewed without the inclusion of data.

A test of 32 varieties of pecans indicated that Schley, Stuart, and Alley are the most desirable for eastern North Carolina. From observations upon the production and character of nuts from individual trees, it is evident that marked variation exists among the trees of a single variety even when grown under the same environmental conditions. Investigations dealing with methods of budding and grafting pecan trees indicated that a combination of both operations should be employed in order to secure the most satisfactory results. Based on experience, it is thought that in order to be entirely successful, top-working, as a general rule, should be confined to trees not over 8 to 10 years of age. Variety tests with the strawberry have not revealed any kinds which show superiority as commercial berries to Klondike and Missionary, well-known sorts.

[**Report of the division of horticulture, Washington Station,** O. M. MORRIS (*Washington Sta. Col. Bul. 167 (1922), pp. 33-35*).—This brief progress report, containing no data, discusses the work of the year ended June 30, 1921. Fertilizer tests in orchards in Spokane Valley indicated that while many of the more common fertilizer materials are of no particular value in that locality, the use of cover crops and nitrogen-bearing fertilizers gives indication of favorably stimulating tree growth and fruit production. Of the cover crops, hairy vetch, field peas, and red clover have yielded gratifying results. Furthermore, it is probable that cover crops should be on the ground during the entire summer season.

In the Wenatchee and Yakima districts, nitrogen-bearing fertilizers are the only ones that have given consistent results, but even here some soils have indicated no response to fertilizers of any kind, leading the author to believe that the physical condition of the soil is more important than the plant food content. Alfalfa has proved specially satisfactory as a cover crop in these sections.

Studies of the factors affecting the keeping quality of fruit seemed to indicate that the degree of maturity attained and the temperature to which the fruit is exposed during or prior to harvest probably exert a marked influence on the keeping quality.

Cabbage strain tests, H. H. ZIMMERLEY (*Virginia Truck Sta. Bul. 37-38 (1922), pp. 211-220*).—A comparative study of several strains of two commercially important cabbage varieties, Early Jersey Wakefield and Charleston Wakefield, carried on at the station for two successive seasons, revealed singular differences in time of maturity, type of plants, yield, and tendency to bloom

without heading. In conformation with the customary practices of this section, the seed was sown in late September, and the young plants set in their permanent location in December. The plats were arranged in triplicate. That portion of the crop harvested in the first three cuttings was designated as early, the balance as late.

The strains of Early Jersey Wakefield ranged in total yield in 1920 from 6.13 to 9.9 tons, in 1921 from 6.54 to 9.87 tons per acre. In 1920 the Charleston Wakefield strains varied in total yield per acre from 7.16 to 11.9 tons and in 1921 from 10.6 to 14.22 tons. Notable differences were also reported in the time of ripening of the different strains of Early Jersey Wakefield. The earliest strain outyielded the latest strain by 4.4 tons per acre during the early part of 1920 and by 4.73 tons during the corresponding period of 1921. Certain of the strains were so late in maturing as to be of no value as an early crop. In many cases earliness was correlated with high yield.

Although the early yields of the Charleston strains were relatively small, quite sharp differences were recorded in this respect, ranging in 1920 from none to 1.93 tons and in 1921 from 0.4 to 3.5 tons. The early strains of Charleston Wakefield were superior to the late strains of Early Jersey Wakefield, both in early and in total yield. The percentage of plants producing premature flowering stalks, given in tabular form for the different strains in 1921, shows a range in Early Jersey Wakefield of 4.7 to 25.3 per cent and in Charleston Wakefield of 14 to 31.3.

In commenting upon the results of the investigation, the author points out that although Early Jersey Wakefield was outyielded by Charleston Wakefield, the early variety is, nevertheless, of equal value on account of maturing a greater proportion of its crop at a time when high prices usually prevail. It is believed that commercial cabbage growers should test seed stocks previous to general planting.

Blanching, harvesting, and marketing of celery, J. L. STAHL (*Western Washington Sta. Bmo. Bul.*, 10 (1922), No. 2, pp. 30-33, figs. 2). This comprises brief practical directions.

Central wire bracing for fruit trees, L. C. BARNARD (*California Sta. Circ.* 244 (1922), pp. 10, figs. 8).—Information is presented relative to the methods and cost of supporting the limbs of fruit trees by a central ring system of wire bracing. This method of bracing, found to be more durable and much less expensive over a period of years than the old system of wooden props, has an added advantage in not interfering with tillage, irrigation, or harvesting operations. Furthermore, the wires, hidden in the trees, do not detract from the appearance of the orchards.

The apricot in California, W. L. HOWARD (*California Sta. Circ.* 238 (1922), pp. 53, figs. 9).—Following a preliminary statement relative to the extent and the location of the apricot growing industry in California, general information is presented concerning the selection of suitable stocks, planning and planting the orchard, pruning systems, wire bracing, cultivation, cover crops, irrigation, thinning fruit, spraying, frost prevention, harvesting, varieties, and cost of production.

Harvesting and handling apricots and plums for eastern shipment, W. P. DURUZ (*California Sta. Circ.* 239 (1922), pp. 24, figs. 21).—This is an illustrated circular of general information pertaining to harvesting, packing, and loading of apricots and plums for transportation to the eastern markets.

Harvesting and handling California peaches for eastern shipment, W. P. DURUZ (*California Sta. Circ.* 241 (1922), pp. 21, figs. 13).—Similar to the above, but dealing with the peach.

Harvesting and handling California pears for eastern shipment, W. P. DURUZ (*California Sta. Circ. 240* (1922), pp. 19, figs. 10).—This is of a similar nature to the above, but relating to the pear.

The handling, shipping, and cold storage of Bartlett pears in the Pacific Coast States, J. R. MAGNESS (*U. S. Dept. Agr. Bul. 1072* (1922), pp. 16).—The Bartlett, estimated by the author to comprise 50 per cent of the Oregon and Washington and 75 per cent of the California pear crop, is produced in those States under a wide range of temperature and humidity conditions. This paper, following an earlier report by the same author (*E. S. R.* 44, p. 42), relates to the following studies: (1) The effect of time of picking upon the keeping, eating, and carrying qualities of Bartlett pears, (2) variation in keeping and carrying qualities of fruit from different sections, and (3) the best method of handling and storing pears.

Finding that pears picked too early were inclined to shrivel and fail to attain a satisfactory edibility, an attempt was made to discover means of ascertaining the proper degree of maturity for picking. Observation of the fruit showed that about the time pears were first picked for shipment a layer of brown colored corky cells was formed over the lenticels. Previous to the formation of this layer immersion of the fruits for from 15 to 30 minutes in a strong solution of methylene blue left a deep blue color in the lenticels, while subsequent dipping left only a slight stain. Although fruit could be picked safely at this stage, it was found that much better quality resulted when the pears were left on the tree for about two weeks longer.

Marked differences were recorded in the number of days that Bartlett pears obtained from different sections would keep. In general, the districts with relatively high temperatures and low humidity produced the longer keeping and better carrying fruits. Data on the prevailing temperatures and comparative keeping characteristics are shown in tabular form for various important Bartlett sections. To offset unfavorable environmental conditions, it is recommended that pears from such sections be precooled as soon as possible after harvesting.

Canning pears should be allowed to remain on the trees until the green color is underlaid with a yellow ground, since during this intervening stage there is a rapid increase in sugar and improvement in flavor. It was found that fruits destined for storage purposes would keep better after removal from the storage if allowed to reach this yellow-green stage of maturity. Storage rooms should be maintained at 30° F., at which temperature pears may be kept from two to three and sometimes five months. Pears removed while still hard and green and allowed to ripen gradually at 60 to 70° developed a satisfactory aroma and flavor.

Scald on stored pears was largely prevented by allowing fruit to reach the yellow-green stage of maturity before harvesting. Of six lots of pears picked from the same trees on June 30, July 9, 14, and 24, and August 3 and 13, the first three lots showed practically 100 per cent scald injury, the fourth 50 per cent, the fifth practically none, and the sixth was entirely free.

Vine pruning systems, F. T. BLOTTI (*California Sta. Circ. 245* (1922), pp. 4, figs. 3).—Three systems of pruning, head, cane, and cordon, deemed by the author to be best adapted to California conditions are described, with discussion of the advantages of each and the varieties for which each system is particularly adapted.

Some changes in the composition of California avocados during growth, C. G. CHURCH and E. M. CHACE (*U. S. Dept. Agr. Bul. 1073* (1922), pp. 22, fig. 1).—A report of chemical and physical studies with several varieties and

seedlings of California-grown avocados examined at different stages of maturity in order to obtain accurate data on the proper stage at which fruits should be harvested when designed for shipment to distant markets. Determinations, the results of which are presented in tabular form, include specific gravity, moisture, ash, fat, sugar, nitrogen, and crude fiber.

The smallest seeded varieties, Fuerte and Sharpless, contained the greatest proportion of edible matter, over 80 per cent. The highest protein content, 4 per cent plus, was found in Lyon. At maturity Fuerte contained almost 30 per cent fat and Lyon and Puebla over 25 per cent, while the minimum, 15 per cent, was found in Dickinson. Taft contained the least fiber of any of the varieties. With the exception of Fuerte, where a slight decrease in density was recorded with the advancing season, the specific gravity did not vary during the successive ripening stages.

The proportion of edible matter increased in all varieties with the approach of maturity, but there were no well-defined lines of demarcation to indicate stages of ripening. The amount of moisture varied inversely with the amount of fat and decreased toward maturity. The fat content showed a constant increase up to a certain stage, which point is thought by the authors to be correlated with satisfactory ripening. The varieties studied reached this stage as follows. Fuerte in December; Puebla in February; Spinks in March; Sharpless in April or earlier; Lyon, Blakenman, and Taft in May; and Dickinson undetermined. Reducing sugars were found to decrease markedly with the approach of maturity, but the range was insufficient to be of any use in estimating degree of ripeness. Crude fiber content showed but little change during the entire development of the fruit.

In comparing data obtained in analyses of fresh and stored samples of the same lots of fruits some important differences were recorded. The specific gravity was found to vary according to variety and to the time of analysis. In several instances the proportion of pulp increased during storage, due, in the author's opinion, to the more complete separation of pulp from skin in ripe than in immature fruits. The variation in water content in fresh and stored avocados was practically negligible, being 0.7 per cent for 40 samples. The percentage of ash was found uniformly higher in stored fruits, a fact which is also deemed by the authors to be due for the most part to the greater ease in separating skin from pulp in ripe fruits, the flesh adjacent to the skin being found to be peculiarly rich in ash. Protein was somewhat higher in the stored fruits, and fat content in stored samples showed a decided tendency to increase while the fruits were still immature. This gain in fat is accompanied by a decrease in sugar content. In conclusion, the authors state that because of the brief duration of the investigation and the limited amount of material at hand they are unable to recommend any maturity standards for any of the varieties studied.

Studies on the irrigation of citrus groves, E. E. THOMAS (*California Sta. Bul.* 341 (1922), pp. 353-370).—Realizing that citrus trees are more sensitive to an excess of water than many other crops and that many growers use excessive quantities of water either intentionally or from the use of improperly arranged systems, studies were conducted in 1916 and 1917 in seven groves in Los Angeles and Orange Counties, Calif., to obtain information on rational irrigation practices. The soils of all seven groves included in the study were of a heavy type, with wilting coefficients ranging from 9 to 19 per cent.

In the belief that irrigation furrows are usually much too long, moisture determinations were made in plats located at the upper and lower ends of 812-ft. furrows, having a fall of 16 ft. The data obtained showed that much

less water was present in the soil of the lower plat than in the upper. The subsoil of the upper plat was also found to contain much more moisture, and, inasmuch as orange roots rarely penetrate below a depth of 4 ft. in heavy types of soils, the water in the lower strata was deemed not only to be of no benefit to the trees but probably to carry down with it certain soluble plant foods.

A study of the effect of location of trees in respect to irrigation ditches on appearance and productivity, in which two adjacent 9-tree plats, one at the upper end of a 528 ft. and the other at the lower end of a 248-ft. furrow, were used, indicated that certain trees in the grove may receive an injurious excess of water. Marked differences were recorded in the appearance of the trees on the respective plats. Those in the lightly irrigated area had an abundance of green leaves and produced a good crop of oranges, while in the heavily irrigated plat the trees dropped many of their leaves and produced only a light crop of fruit. In 1917 the lightly irrigated plat yielded 55 boxes and the other 24 boxes of fruit.

In order to ascertain the best periods for applying water, determinations were made of the available moisture in the soil of groves that were irrigated at 30, 45, and 60-day intervals. The data, given in tabular form, indicate that of the three periods, the 60-day was the most satisfactory. All the plats probably received more water than was essential for the best development of the trees.

To determine the comparative effect of deep and shallow cultivation on the water-absorbing power of the soil, two adjacent groves of similar soil type and both watered at 60-day intervals were subjected to different cultural soil treatments. In one the soil was harrowed lightly after it had become sufficiently dry to work and later was tilled to a depth of 7 to 9 in. In the second grove the soil was harrowed to a depth of 3 to 5 in. before it was properly dried, followed by two or three cultivations of a similar nature during the interim preceding the next irrigation. As a result, the trees in the improperly tilled area suffered from a lack of moisture, both fruit and leaves becoming wilted. The moisture content of the third and fourth feet of soil in the poorly tilled area remained below the wilting coefficient after July 5 and was below wilting in the upper 2 ft. for a part of the time.

FORESTRY.

Important forest trees of eastern United States (*U. S. Dept. Agr., Dept. Circ.* 233 (1922), pp. 11).—The information contained in this circular is reprinted from Department Bulletin 863 (*E. S. R.*, 44, p. 94).

A manual of Indian timbers. J. S. GAMBLE (*London: Sampson Low, Marston & Co., Ltd.*, 1922, 2. ed. [rev. and enl.], pp. XXVI+868, pls. 21).—This reprint of the second edition with some additions and corrections presents an account of the growth, distribution, and uses of the trees and shrubs of India and Ceylon, including technical descriptions of their wood structure.

The western larch in cultivation. A. HENRY (*Quart. Jour. Forestry*, 16 (1922), No. 3, pp. 161-174).—A report on the behavior of *Larix occidentalis* in Europe, in which it is asserted that this species apparently is not adapted to European conditions, being equally as subject to canker as the indigenous species and exceedingly difficult to propagate in the nursery. In many cases the good trees averaged only from 5 to 10 per cent. Furthermore, on account of the erect, narrow habit of growth, the tree is unable to assist in suppressing the grass which ordinarily is very abundant in plantations.

Evaporation and soil moisture in relation to forest planting. C. F. KORSTIAN (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 116, 117).—In studies

conducted in the Manti National Forest, Utah, by the U. S. D. A. Forest Service to determine the value of natural plant growth as a guide to the value of sites for forest planting, records were taken in connection with experimental plantings of western yellow pine (*Pinus ponderosa*) upon the evaporating power of the air and upon the moisture content of the soil on five different sites, namely, manzanita (*Arctostaphylos platyphylla*), wild apple (*Peraphyllum ramosissimum*), sagebrush (*Artemisia tridentata*) flat, sagebrush flat denuded of all vegetation, and oak brush (*Quercus gambelli*). The air readings were taken with the aid of the Livingston porous cup atmometer, and soil samples were collected at 10-day intervals.

The evaporating power of the air and the available soil moisture appeared to be the chief physical factors in limiting the growth of plants in the chaparral zone, the results indicating that a satisfactory expression of the two factors could be indicated by the ratio of evaporation to soil moisture. The study of natural vegetation as indicator of the value of soil for forest plantings leads to the conclusion that the presence of plants with deep roots and with crowns capable of affording partial shade, sufficient to protect but not to smother young forest trees, is suggestive of successful afforestation.

Detection of overgrazing by means of indicator plants, M. ANDERSON (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 56-58) - The existence of various plants, including sneezeweed (*Helenium hoopesii*), niggerhead (*Rudbeckia occidentalis*), tarweed (*Madia glomerata*), yellow mustard (*Sophia incisa*), knotweed (*Polygonum* sp.) and senecio (*Senecio* sp.), on grazing lands to an extent which indicates the suppression of more desirable species is considered satisfactory evidence of an overgrazed condition. Furthermore palatable shrubs, such as the serviceberry (*Amelanchier* sp.), and snowberry (*Symphoricarpos* sp.), when injured by overgrazing were found to be present either in a stubby, unhealthy condition or wholly dead. The absence of reproduction of aspen on areas naturally supporting this tree is also described as an indication of overgrazing. Suggestions are given for the prevention of overgrazing by the erection of fences regulating the movement of cattle.

The relative cost of making logs from small and large timber, D. BRUCE (*California Sta. Bul.* 339 (1922), pp. 317-333, fig. 1) - An economic study, the results of which are presented largely in tabular form, dealing with the cost of various operations involved in the falling, limbing, marking, and bucking of logs in large lumbering enterprises in the Sierra Nevada Mountains, Calif.

In a study of the influence of variation in trunk diameter at breast height upon the cost of logging, computations were made for each 2-in. gradation for logs ranging between 18 and 48 in. A gradual increase was observed in the cost of operations correlated with decrease in diameter. It cost three times as much per M. B. M. to make logs from 18-in. as from 48-in. trees, and it is believed that the costs would undoubtedly rise rapidly with each further decrease in size below 18 in. A graphical delineation of the total cost and of the cost of each of the four associated operations shows that limbing was the only one of the four operations whose cost did not rise with the decline in diameter.

Lumber: Its manufacture and distribution, R. C. BRYANT (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1922, pp. XXI+539, figs. 156) - Prepared as a forest school text and reference book for instructors and students in lumbering, this well-illustrated treatise embraces a discussion of the entire field of lumber production, including manufacturing equipment, lumber manufacture, markets, and marketing.

DISEASES OF PLANTS.

Division of plant pathology, F. D. HEALD (*Washington Col. Sta. Bul.* 167 (1922), pp. 38-43).—In continuation of previous studies (E. S. R., 45, p. 242) the author gives an account of studies of the relation of spore load of individual grains to the percentage of smut in wheat. The experiments again indicate that resistant varieties when seeded in the spring will rarely have sufficient smut to justify the expense of seed disinfection. It is also found that it will be possible by microscopical analyses to predict the percentage of smut which will appear in the spring seedlings, and will indicate when the omission of seed disinfection is practical. Continued investigations in seed treatments showed that perfect control was secured by treating seed with hypoform, chlorophol, copper carbonate dust, anhydrous copper sulphate dust, and sulphur without any injury to germination. Seed treated with formaldehyde and copper sulphate gave a reduced germination and some traces of smut.

The occurrence of foot rot of wheat in the Spokane Valley is reported, and in connection with the disease a fungus was found in constant association with the basal lesions, but all attempts to secure a spore-bearing form have failed.

The results of continued observations on the western blight or yellows of tomato are given in which the author reports the failure to secure cultures of *Rhizoctonia*. Isolations made from diseased material showed that both *Rhizoctonia* and *Fusarium* are present, and the possibility of the two fungi acting together to produce the disease is being investigated.

A brief report is given of plant diseases observed in the survey of the State. Among the new diseases reported are head smut of proso, due to *Ustilago panicea miliacei*, nematode disease on carrot and strawberry, root knot of strawberry, *Rhizoctonia* disease of watermelon, and the blister rust of white pine.

Fruit and vegetable diseases, E. C. STARKMAN, J. G. LEACH, and J. L. SEAL (*Minnesota Sta. Bul.* 199 (1922), pp. 7-75, figs. 38).—A popular description is given of fruit and vegetable diseases known to occur in Minnesota, together with brief discussion of general control measures, and specific control measures are given wherever such are known.

[**Phytopathological studies, Rome**] (*R. Sta. Patol. Veg. Rome, Bol. Mens.* 1 (1920), Nos. 3-4, pp. 50-53; 7-8, pp. 101, 102; 2 (1921), Nos. 1-4, pp. 34-36; 7-9, pp. 94, 95).—Brief notes in the first of these four numbers refer to studies on *Marssonina juglandis* in walnut branches, *Asterocystis radicis* (in association with a *Pythium*) on tobacco seed plants, *Gloeosporium* sp. in oak, and on resistance to cold as studied by Pantanelli and previously noted (E. S. R., 39, p. 525; 43, p. 226). The second number deals with a leaf scorch of *Iris florentina* and *I. germanica* in Italy, associated with a fungus (supposedly *Septoria iridis*), also abnormalities in floral shoots of an *Acacia*, due supposedly to *Aecidium schuelfuthii*, and branch knots of *Cissus* sp. due apparently to a *Uromyces* (probably *U. cladomans*). In the third number brief accounts are given regarding mycorrhizal relations between Basidiomycetes and arboreal phanerogams, the ascophore form of *Rhacodiella castaneae* (*Sclerotinia pseudotuberosa*?), and the ascophore form of oak *Oidium* (*Microsphaera* sp.). The notes in the fourth number refer to a *Menispora* (*M. microspora*) on chestnut, the identity of *Aerospora mirabilis* with *Spirospora castaneae*, and a severe disease of almond tree (*Fusicladium amygdali*).

Work of the phytopathological laboratory of the Scientific Institute of Indo-China, F. VINCENS (*Bul. Agr. Inst. Sci. Saigon [Cochin China]*, 3 (1921), No. 10, pp. 307-323).—Besides dealing with insect pests, this account gives notes regarding cryptogamic diseases of rice, rubber, and other economic plants, indicating causes where known.

Alternate hosts and biologic specialization of crown rust in America, I. E. MELHUS, S. M. DIETZ, and F. WILLEY (*Iowa Sta. Research Bul. 72 (1922), pp. 211-236, figs. 2*).—As a contribution to the crown-rust problem and its control, the authors report investigations with the common grass hosts of crown rust growing in oat-producing sections.

It was found that crown rust (*Puccinia coronata*) on oats and *Calamagrostis canadensis* may use all of the American and two introduced species of *Rhynchospora* as alternate hosts. The separation of the species into several species or forms is not considered justifiable in America. Crown rust on oats produced normal necidia on *R. cathartica* and *R. lanceolata* from which the rust spreads to oats, and these two species of *Rhynchospora* are considered the most dangerous ones in the oat-growing portions of the country. The four most common grass hosts in the oat-growing sections of the United States are said to be *Avena sativa*, *C. canadensis*, *Lolium perenne*, and *Holcus lanatus*.

The form of crown rust on oats is said to be neither highly specialized nor limited in its host range, 6 tribes of grass embracing 16 genera being subject to attack. The form occurring on *C. canadensis* attacked 14 genera of grasses, and that on *Lolium* is able to infest 13 genera. The form occurring on *Holcus* was the most highly specialized to host range of the forms studied, being confined to a single genus of host plant. Oats was found to be a common host, with varying degrees of infection for all of the forms of crown rust studied.

A bacterial disease of the Arum, W. F. BEWLEY (*Gard. Chron., 3. ser., 69 (1921), No. 1787, p. 152*).—A serious disease of Arum, briefly described, is being investigated. The causal organism proves to be a bacillus, apparently not identical with *B. arondeae* causing a rot of the calla lily but identical with an organism which has been under investigation for some months and which produces a rot of tomato fruits, potato tubers, cabbage stalks, and turnips. It is transmitted in drainage water and manure and is favored by heavy watering. Treatment, apparently successful, involves removal of the corms from the soil and treatment with formaldehyde, mercuric chlorid, or hot water.

Lime as a cure for clubroot disease (*Gard. Chron., 3. ser., 69 (1921), No. 1792, pp. 205, 206*).—Lime, though effective as a remedy for clubroot disease, is so slow to mix with the soil that, according to examples cited, four years or more may elapse before it can act effectively upon the plants to prevent the disease.

Cereal smut control, E. HENNING (*K. Landtbr. Akad. Handl. och Tidskr., 58 (1919), No. 7-8, pp. 431-449, figs. 4*).—Experimentation is detailed in tabular form with discussion, as carried out during 1919 on control through seed treatments of stinking smut (*Tilletia tritici*), flag smut (*Urocystis occulta*), and loose smut (*Ustilago hordei*).

Stinking smut and physiological splitting, VON CARON-ELDINGEN (*Deut. Landw. Presse, 47 (1920), No. 75, p. 514, fig. 1*).—Methods and means tending to lessen or exclude physiological variations are relied upon to minimize cereal stinking smut.

The use of chloropicrin as a disinfectant of cereal seed, A. PIUTTI and A. MANGO (*Gior. Chim. Indus. ed Appl., 2 (1920), No. 12, pp. 677-682*).—Parasiticidal efficacy is claimed for chloropicrin if used in the dosage and under the conditions here detailed.

Oat dry spot, R. SCHERPE (*Arb. Biol. Reichsanst. Land u. Forstw., 10 (1920), No. 4, pp. 307-358*).—A detailed study has been made of oat dry spot, dealing chiefly with the presence and proportions of substances intended to supply nutrient, stimulant, or other requirements as influencing this disease.

On the supposed occurrence of seedling infection of wheat by means of rusted grains, W. L. WATERHOUSE (*Ann. Appl. Biol.*, 8 (1921), No. 2, pp. 81, 82).—As bearing upon the claim of Hungerford (E. S. R., 43, p. 546) that stem rust is not transmitted from one wheat crop to the next by means of infected seed grain, the author carried out a histological examination of rusted seed wheat grains, the results of which are said to confirm Hungerford's conclusions. It is considered extremely unlikely that rust mycelium in wheat grains brings about infection of the plant. The mycelium of other fungi is often present in the developing plant, however, and this might be mistaken for a rust infection.

Wheat yellow rust, E. HENNING (*K. Landtbr. Akad. Handl. och Tidskr.*, 58 (1919), No. 7-8, pp. 401-418, pl. 1; also in *Meddel. Centralanst. Försökav. Jordbruksområdet*, No. 192 (1919), pp. 3-20, pl. 1).—An account (partly tabular) is given of wheat yellow rust (*Puccinia glumarum*) in Sweden, of resistance thereto, and of factors influencing prevalence.

A new cucumber disease, T. LINDBÖRS (*K. Landtbr. Akad. Handl. och Tidskr.*, 58 (1919), No. 7-8, pp. 424-430, figs. 7).—*Venturia cucumerina* n. sp. is technically described in connection with a cucurbit disease, which is discussed in connection with an account of infection experiments.

Potato diseases, QUANIER (*Soc. Path. Vég. France, Bul.* 7 (1920), No. 4, pp. 102-118).—In addition to a discussion of the little-known forms of potato disease, attention is given to several obscure potato diseases as regards their real nature, propagation, and suggested control measures.

Potato leaf roll (*Deut. Landw. Presse*, 48 (1921), No. 12, pp. 81, 82).—Discussion is given of the results of recent research in Holland and elsewhere on potato leaf roll.

Corky scab in potatoes (*Gard. Chron.*, 3 ser., 69 (1921), No. 1763, pp. 97, 98).—Owing to the fact that the combined effect of corky scab and second growth had caused the impression that resistance to wart disease had broken down in some of the immune varieties, and owing also to the seriousness of corky scab in certain districts, experiments were started to test the resistance of certain forms to corky scab, using varieties generally immune to wart disease in soil known to be seriously infected with the scab organism. The results are given in detail for the several varieties.

Treatment of seed potatoes for scab and black scurf, J. G. BROWN (*Arizona Sta. Timely Hints for Farmers*, No. 136 (1922), pp. 4, fig. 1).—Arizona soils, particularly those in the southern part of the State, are said to be comparatively free from potato scab (*Oospora*) and black scurf (*Rhizoctonia*), though the former is often and the latter is almost always present on seed potatoes shipped in for seeding purposes.

Suggestions regarding protection and involving seed treatments include the mercuric chlorid method, regarded as the best, and the formaldehyde method.

Second report on the reaction of American potato varieties to the wart disease, F. WEISS and C. R. ORTON (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 57).—Tests are reported of varieties of potatoes in regard to their susceptibility to potato wart disease. Up to the present, 78 named varieties of American origin have been tested, of which 27 have been found immune. Of 51 seedlings from the U. S. Department of Agriculture, 12 were immune to the disease.

The present status of the potato wart in Pennsylvania, W. A. McCUBBIN (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 58).—As a result of surveys in 1920 and 1921, the potato wart was found in 53 towns and villages in 9 counties in Pennsylvania. The actual area infected is said to be less than 100 acres.

Wart disease in potatoes and soil sterilization (*Gard. Chron.*, 3. ser., 69 (1921), No. 1779, p. 49).—Experimentation at Bristol, at Ormskirk, and in Lincolnshire (the first mentioned credited to Barker, the last mentioned to Russell) gave discordant though in part encouraging results.

The problem of the inheritance of immunity to wart disease in the potato, E. J. COLLINS (*Gard. Chron.*, 3. ser., 70 (1921), Nos. 1821, p. 260; 1822, p. 271, figs. 2; 1823, p. 290; 1825, p. 314; 1826, p. 326).—Following an examination of theoretical considerations and experimental data, the conclusion is reached that seedling potatoes should undergo wart disease trials in their first or second year, either in trial ground or by inoculation. Some means should be devised whereby promising stocks and breeding types held by southern scientific breeders could be fostered under more favorable conditions. The evidence brought forward points to the inheritance of susceptibility to wart disease as a dominant factor in potato.

A Phytophthora crown rot of rhubarb, W. S. BEACH (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 55, 56).—A crown rot of rhubarb prevalent in Philadelphia County, Pa., in which the buds, petiole bases, and roots are affected, is described.

Fungus diseases [of sorghum millet in East Africa], H. MORSTATT (*Arb. Biol. Reichsanst. Land u. Forstw.*, 10 (1920), No. 3, pp. 263-267).—Fungi briefly discussed as found in East Africa affecting sorghum millet include *Ustilago cruenta*, *U. relliana*, *U. sorghi*, *Tolysporium volkensii*, *T. fuliferum*, *Puccinia purpurea*, *Botryodiplodia sorghi*, *Cercospora sorghi*, *Colletotrichum andropogonis*, and *Darlucia sorghi* on *P. purpurea*.

Beet nematodes, N. A. KEMNER (*K. Lanthbr. Akad. Handl. och Tidskr.*, 59 (1920), No. 2, pp. 125-130, figs. 2).—Discussion is given of injury to beets by nematodes (*Heterodera schachtii*) and of attempts at control.

The mosaic or mottling disease of the sugar cane: The main facts of the case to date, C. A. B[ARBER] (*Internatl. Sugar Jour.*, 23 (1921), No. 265, pp. 12-19, pl. 1).—An attempt is made to present in compact form the main significant facts to date regarding sugar cane mosaic, the present outlook, and the possibilities regarding its control. To this is added a short list of related publications.

An important new disease of the cultivated sunflower, H. E. MORRIS and D. B. SWINGLE (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 50).—In the summer of 1920, the authors observed a new disease of sunflowers in several parts of Montana. The disease seemed to be associated closely with a fungus corresponding to *Sclerotinia libertiana*. The roots and crowns are attacked, causing the plants to wilt and quickly die. The disease spreads in the field by extension of mycelium through the soil, and if it attacks fields when the plants are small heavy damage may be expected.

Treatment of tobacco seed and suggested program for control of wildfire and angular spot, F. D. FROMME and S. A. WINGARD (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 48, 49).—A description is given of a method of treating tobacco seed with formaldehyde solutions for the control of these diseases. The seed treatment should be supplemented by the use of new cloth for the plant bed cover, rotation or sterilization of the seed bed, and field rotation.

Wildfire of tobacco in Connecticut, G. P. CLINTON and F. A. MCCORMICK (*Connecticut State Sta. Bul.* 239 (1922), pp. 365-423, pls. 4).—In connection with a survey of the tobacco situation in Connecticut in 1920, the presence of the wildfire disease of tobacco due to *Bacterium tabacum* was revealed. In the present publication an account is given of subsequent studies of the disease and the results of experiments for its control. The characteristics of the dis-

ease as it appears in the seed bed and field are described, and suggestions are given of possible methods of introduction, agents of dispersal, overwintering, distribution in the State, etc.

In laboratory studies the authors isolated *B. tabacum* from wildfire spots on tobacco leaves. The organism was studied in detail and comparisons made with *B. angulatum*, the attributed cause of the angular leaf spot of tobacco (E. S. R., 40, p. 848). The relations of the parasite to its host, environmental conditions, etc., are described in detail.

As a result of the investigations, suggestions are offered for the control of the disease, which involve seed bed and field operations. In the seed bed the authors recommend sterilization of soil, sowing seed from regions known to be free from the disease, care in watering and ventilation, and spraying with 4-4 50 Bordeaux mixture at weekly intervals, beginning with very small seedlings and continuing until planting in the field has been concluded. In the field diseased plants should not be set, and if disease is found prompt roguing is recommended. If the field is badly attacked the crop should be plowed under. Where only a moderate amount of the disease is present late in the season infected leaves may be removed from the plants and taken from the field.

Inheritance of disease resistance to *Thielavia basicola*, J. JOHNSON (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 49).—The resistance of a cross of the susceptible White Burley variety of tobacco and the resistant Little Dutch type to *T. basicola* is reported. The first generation crosses proved intermediate in resistance, and the second generation showed all types of resistance. Selected types of the third generation continued to vary in some cases, while others bred true for the resistant character. Susceptibility is considered the recessive condition.

A new seedling disease of tobacco, C. M. SLAGG (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 49).—A disease of tobacco due to *Fusarium affine* is reported from Fayette County, Ky. Inoculations made upon seedlings in the greenhouses in Madison, Wis., reproduced the field symptoms on leaves and stems. The disease is said to produce a variety of symptoms, ranging from a type of damping-off in humid air to a slight browning of the stems in less humid air.

[Control of "sand-drown" of tobacco] (*North Carolina Sta. Rpt. 1921*, p. 14).—As a result of a single experiment, it is claimed that the application of dolomitic limestone at the rate of 1,000 lbs. per acre will prevent "sand-drown," a common tobacco disease. It was also found that the disease could be checked in the early stages by a side application of magnesium.

Apple diseases and their control, W. B. MABEE and R. A. JEHLE (*N. C. Dept. Agr. Bul.*, 1921, Mar., pp. 14-23, figs. 5).—Accounts and descriptions are briefly given of diseases causing economic loss to apple growers in different portions of North Carolina.

Prevention of apple scab (*Gard. Chron.*, 3 ser., 70 (1921), No. 1812, pp. 148, 149).—A market grower reports a test of winter spraying only for apple scab and other skin blemishes. While results with lime sulphur are contradictory in some respects, it is asserted that in two plantations a winter Burgundy spray gave practically clean fruit in case of such varieties as Cox Orange Pippin, Arlington Pippin, and Worcester Pearmain. This confirms previous results obtained with copper sulphate, and is considered to warrant a positive conclusion regarding its value when used in winter as a scab preventive. Sulfate (potash) manuring, where needed, is also said to insure cleaner fruit, presumably by increasing resistance to disease.

A core rot of apple and pear, B. PEYRONEL (*R. Staz. Patol. Veg.*, Rome, *Bol. Mens.*, 2 (1921), No. 1-4, pp. 23-27, figs. 3).—A rot originating in the core

and spoiling the fruit, in case of both apple and pear, is associated with *Trichothecium roseum*.

On the occurrence in Britain of the ascigerous stage of a brown rot fungus, H. WORMALD (*Ann. Bot. [London]*, 35 (1921), No. 137, pp. 125-135, pls. 2).—A *Sclerotinia* found on mummified plums at Wye in March, 1920, has been shown by cultural experiments in the laboratory and inoculations on fruit trees in the open to be the apothecial stage of the gray *Monilia* commonly found on plums and cherries in Great Britain. The fungus, which is described, is referred to *S. cinerea*.

Varietal resistance to American gooseberry mildew in red currants, E. S. SALMON and H. WORMALD (*Gard. Chron.*, 3. ser., 70 (1921), No. 1804, p. 47, fig. 1).—In the fruit plantations at Wye College, Kent, an outbreak (of unusual virulence) of American gooseberry mildew has been followed by the appearance of this mildew on certain varieties of red currant. A variety, supposedly Raby Castle, is shown with the summer (conidial) stage on the leaves and the winter (perithecial) stage on the stem (though not confined to the stem but occurring also, it is said, on the leaves). Fay Prolific intermingled with these plants and producing equally sappy young shoots remained immune. Other evidences of the resistance of Fay Prolific were obtained.

New disease of gooseberries [in Sussex] (*Gard. Chron.*, 3. ser., 70 (1921), No. 1821, p. 262).—Losses ranging as high as 50 per cent of the bushes to growers of gooseberries in Sussex are said to have been caused during 1921 by *Armillaria mellea*.

Grape diseases, R. AVERNA-SACCÀ (*Bol. Agr. [Sao Paulo]*, 22. ser., No. 1-2 (1921), pp. 6-15, figs. 4).—Discussion of local grape diseases is here confined to *Capnodium salicinum* and *Pestalozzia uvicola*.

Peronospora control, G. CUBONI (*R. Staz. Patol. Veg.*, Rome, *Bol. Mens.*, 1 (1920), No. 3-4, pp. 35-40).—Milk of lime is claimed to possess a fungicidal value very much lower than that of copper compounds, though the comparatively high price of the latter may tend to continue the use of the former.

Bordeaux mixture without copper, G. B. TRAVERSO (*R. Staz. Patol. Veg.*, Rome, *Bol. Mens.*, 2 (1921), No. 1-4, pp. 30-33).—This refers to a discussion of the claims of Villedieu noted previously (*E. S. R.*, 47, p. 250).

The inadequacy of sprays without copper, G. BENCKER (*Prog. Agr. et Vitte. (Ed. l'Est-Centre)*, 42 (1921), No. 38, pp. 279-281).—Further argument is offered regarding the claims of Villedieu (*E. S. R.*, 47, p. 250).

Citrus diseases and remedies (*Citrus Indus.*, 2 (1921), No. 10, p. 21).—An attempt is made by the Florida Agricultural Extension Division to give necessary first-hand information regarding citrus foot rot, scab, withertip, die-back, and stem-end rot.

A study of the structure of the stomata of two species of citrus in relation to citrus canker, F. T. McLEAN (*Bul. Torrey Bot. Club*, 48 (1921), No. 4, pp. 101-106, fig. 1).—The essential differences between Szinkum mandarin, which is resistant to citrus canker, and Florida seedling grapefruit, which is susceptible, are believed to consist in differences in the character of the stomata. The differences are such as practically to exclude water from the stomata in case of the mandarin, whereas it more readily enters the grapefruit. A fact considered to be significant in this connection is that the bacteria are motile in water only.

Cause of wastage in export of citrus fruits [I. B. P. EVANS ET AL.] (*Citrus Indus.*, 2 (1921), No. 10, pp. 20, 21).—A compact summary is given of the reports already noted (*E. S. R.*, 46, p. 652).

Mistletoe on lime trees, L. A. BOODLE (*Roy. Bot. Kew, Bul. Misc. Inform.*, No. 5 (1921), pp. 212-215).—A short account is given of the nutritive

and other relations between *Viscum album* and its lime tree hosts in England, particularly as connected with the production of abnormal growths, rots, or cavities in the hosts or with the reduction in size or disappearance of the mistletoe.

[Diseases of coconut palms in East Africa], H. MORSTATT (Arb. Biol. Reichsanst. Land u. Forstw., 10 (1920), No. 3, pp. 228-242).—This portion of a report which includes also insect pests deals in a systematic way with fungus diseases of coconut palms in connection with fungi as follows: *Flammula paxiana*, *Lenzites cyclogramma*, *Psilocybe samaoensis*, *Fomes obesus* (*Ungulina obesa*), *F. lucidus*, *F. scmitostus*, *Poria ravenalae*, *Trametes decussata*, *Typhula hyalina*, *Uredo palmarum*, *Graphiola cocoina*, *Meliola palmarum*, *Limacinia tangaensis*, *Zukalia stuhlmanniana*, *Laestadia cocophila*, *Rosellinia sancta-cruciana*, *R. rhachidis*, *R. cocoes*, *Sphaerella gastonis*, *S. zonata*, *Chaetomium orientale*, *Metasphaeria cocogena*, *M. cocoes*, *Hypoxyton cocoinum*, *Xylaria radicata*, *Valsa chlorina*, *Eutypella cocos*, *Anthostoma cocoes*, *Asteridium ferrugineum*, *Lophiosphaeria tahitensis*, *Lachnea cocoes*, *Pythium palmivorum*, *Physarum chlorinum*, *Phyllosticta cocoina*, *P. cocos*, *Phoma cocoina*, *P. palmarum*, *P. striolata*, *Macrophoma palmarum*, *Cytospora palmicola*, *Coniothyrium cocoes*, *C. palmicolum* (*Sphaeria palmicola*), *Sphaeropsis cocoina*, *Chaetomella* sp., *Diplodia cocina*, *D. cococarpa*, *D. cococarpa malaccensis*, *D. palmicola*, *D. epicocos* (*S. palmarum*), *Chaetodiplodia diversispora*, *Botryodiplodia* sp., *Lasiodiplodia theobromae*, *Amphisphaeria cocos*, *Sphaeria columnaris*, *Aschersonia pistiformis*, *Endocalyx melanoanthus*, *Coryncium cocoes*, *Pestalozzia palmarum*, *P. fuscescens sacchari*, *Hyalopus yronis*, *Mycogone* sp., *Trichosporium palmicolum*, *Helminthosporium incurratum*, *Thielaviopsis paradoxa* (*T. ethacetica*), and *Graphium* sp. It also deals briefly with *Bacillus coli* in connection with bud rot. An account is added of losses due to inorganic agencies, including unfavorable soil conditions, drought, volcanic gases, lightning, and wind, and of losses due to such causes as gummosis, little leaf, nut rot, and a leaf tissue-destroying disease of unknown character.

An almond tree disease, V. RIVERA (*R. Staz. Patol. Veg., Rome, Bol. Mens.*, 2 (1921), No. 1-4, pp. 28, 29).—This disease of the almond tree, the first stage of which is marked by apparent normality externally, the second by evident general decline, and the third by death of branches and finally the tree, is caused by *Fomes fulvus*.

Some studies relating to infection and resistance to walnut blight, C. O. SMITH (Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 9, pp. 367-371, fig. 1).—Walnut blight (*Pseudomonas juglandis*), attacking leaves, nuts, catkins, and tender shoots of English walnut (*Juglans regia*), is probably transmitted only through the old blight lesions in which the organism remains alive during the dormant period, coming to the surface under favorable conditions. It may occur on the surface of both leaf buds and catkin buds before spring growth begins, though the actual significance of such occurrence has not been fully established. Infection may not occur before the new growth appears in spring. Fog, dew, and late rains appear to be important agents in the spread of the disease. Insects may carry the infection to some extent, and pollen has recently been shown to carry it.

From inoculated sterilized soils the blight organism was isolated for 18 days but not after 25 days. Soil is probably not important as a carrier. Though the variety Ehrhardt appears less susceptible than Placentia and Seedlings, varietal differences as regards resistance are generally slight and may have comparatively little significance from the standpoint of protection against walnut blight.

Septoria leaf blight on the China aster, W. O. GLOYER (*Abs. in Phytopathology*, 11 (1921), No. 1, pp. 50, 51).—Commercial plantings of the China aster (*Callistephus chinensis*) in New York, are said to have been severely attacked by *Septoria callistephi* n. sp. The organism is briefly described, and it is believed that seed disinfection and spraying the plant with Bordeaux mixture would be satisfactory control measures.

The isolation of the organism causing crown gall on *Chrysanthemum frutescens* in Britain, H. WALKDEN (*Ann. Bot. [London]*, 35 (1921), No. 137, pp. 137, 138).—It is claimed that a bacillus has been isolated from crown gall occurring in Great Britain, the characters of which appear to be identical with those of a type culture of *Bacterium tumefaciens*.

The snowdrop fungus, S. ARNOTT (*Gard. Chron.*, 3. ser., 69 (1921), No. 1780, p. 70, fig. 1).—After timely removal of snowdrop bulbs affected with *Botrytis (Polyactis) galanthina* and a dressing of the soil with flowers of sulphur, the disease did not appear even during the following season.

The ascophore form of *Rhacodiella castaneae*, the cause of chestnut black canker, B. PEYRONELL (*Atti R. Accad. Naz. Lincei*, 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat., 29 (1920), 11, No. 10, pp. 324–327).—The fungus, *R. castaneae*, formerly indicated (E. S. R., 42, p. 747) as causing chestnut black canker, is further discussed as to its characters, forms, and affinities.

Control of white pine blister rust in Connecticut, W. O. FILLEY and H. W. HICOCK (*Connecticut State Sta. Bul.* 237 (1922), pp. 303–326, pls. 5).—A description is given of the white pine blister rust for the control of which, in Connecticut, cooperative experiments between the station and the U. S. Department of Agriculture have been carried on since 1916. As a result of attempts to control this disease, it is claimed that the eradication of currant and gooseberry bushes to a distance of 1,000 ft. from white pine will, in most cases, adequately protect the pine from the disease. The eradication of *Ribes* is said to be practicable, even in regions where the wild species are abundant, and the work can be done by land owners at a comparatively low cost.

A survey of white pine within the State was made, and it is estimated that the present stand is 150,000,000 ft. B. M., most of which is in five counties.

A summary account is given of investigations carried on by G. P. Clinton and F. A. McCormick on the life history of the fungus causing the blister rust, a preliminary account of which has already been noted (E. S. R., 42, p. 247). Among the principal points brought out by their investigations were that infection takes place through the leaves, and that seedlings of certain two and three needle pines can be artificially infected as readily and vigorously as the white pine.

Some aspects of root diseases of *Hevea brasiliensis* in Malaya, A. R. SANDERSON (*India-Rubber Jour.*, 61 (1921), No. 25, pp. 27, 28).—It is stated that at present 20 different species of fungi are known to attack rubber trees in the eastern Tropics. The root fungi almost invariably cause the death of the host after a shorter or longer time, the tree usually being doomed by the time the disease becomes apparent. The causal fungi are usually already present in the jungle timber, especially in the buried wood, before the Hevea is planted. Clearing the soil of this harboring material is considered a most important as well as expensive measure.

Fungi causing root diseases of *H. brasiliensis* in Malaya include *Fomes lignosus*, *F. pseudo-ferreus*, *F. lamaoensis*, *Poria hypobrunnea*, *Polyporus rugulosus*, *Ustilina zonata*, and *Sphaerostilbe repens*.

Some of the fungi which attack Hevea roots are wound parasites, and the entrance of each is greatly facilitated by wounding of the roots.

Selective thinning out is regarded as a valuable protective measure. Drainage and soil aeration are also insisted upon.

Phloem necrosis (brown bast disease) in *Hevea brasiliensis*, A. S. HORNE (*Ann. Bot. [London]*, 35 (1921), No. 139, pp. 457-459).—An account is given, based on the work noted below, regarding the actual condition and causation in cases of brown bast of *H. brasiliensis*.

On brown bast and its immediate cause, J. B. FARMER and A. S. HORNE (*India-Rubber Jour.*, 61 (1921), No. 25, pp. 25, 26, figs. 22).—Recording briefly the results of their study, the authors claim that repeated investigations show that brown bast is due exclusively, in young bark layers, to a peculiar degeneration of the walls of the sieve tubes sufficient to prevent them from discharging their proper functions. In the middle and outer layers the discolored areas are larger, owing to the fact that other cells, parenchyma, medullary rays, and laticiferous vessels, all become involved in the local tissue degeneration. Incipient stages of the burr formation have been observed.

Importance is attached to the fact that in a specimen of bark from a diseased tree showing degenerated outer sieve tubes, the youngest ones were healthy, and the tree appeared to be recovering from brown bast. Apparently, stripping or scraping ameliorates the condition.

Moldy rot [of recently tapped Hevea bark], M. AMIN (*Agr. Bul. Fed. Malay States*, 8 (1920), No. 3, pp. 174, 175).—Renewing bark of rubber trees is attacked about an inch above the tapping cut by a *Sphaeronema*. The disease starts with small depressed black spots which spread and soon present a grayish bloom. Dampness favors the appearance and progress of the disease, which may start in low land and spread up the slopes, being favored by moisture. Tapping operations may spread the infection, as may also wind and insects.

Treatments as outlined include fortnightly application to all trees of a mixture of tar, Brunolinum Plantarium, and water in the proportion of 10:25:65. Ten per cent Agrisol is said to be an effective substitute for the above.

Certain host plants of *Fomes lignosus* and *Ustilina zonata*, F. W. SOUTH (*Agr. Bul. Fed. Malay States*, 8 (1920), No. 4, pp. 242, 243).—On an estate in Selangor young rubber trees were attacked by *F. lignosus*, which extended at least 2 ft. down the main roots. *Areca catechu* is recorded as a new host plant of *U. zonata*.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Annual report of the Governor of Alaska on the Alaska game law, 1921, S. C. BONE (*U. S. Dept. Agr., Dept. Circ.* 225 (1922), pp. 7).—This is the usual annual report on the Alaska game law (*E. S. R.*, 45, p. 358).

Control of the pocket gopher in California, J. DIXON (*California Sta. Bul.* 340 (1922), pp. 337-350, figs. 5).—Following a brief introductory account of the pocket gopher (*Thomomys* sp.) the author discusses methods of destruction, including poisoning with strichnin, trapping, flooding, fumigation with carbon bisulphid and gasoline, and the encouragement and protection of the gopher's natural enemies.

This bulletin is a revision of Bulletin 281, previously noted (*E. S. R.*, 37, p. 757).

The rat and the poultryman, L. K. COUCH (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 2, pp. 47, 48).—Methods of combating this enemy of poultry are briefly considered.

The common hawks and owls of California from the standpoint of the rancher, J. DIXON (*California Sta. Circ.* 236 (1922), pp. 17, figs. 13).—This is a

popular summary of information on the more important hawks and owls in California.

The starling: Is it injurious to agriculture? W. E. COLLINGE (*Jour. Min. Agr.* [London], 27 (1921), No. 12, pp. 1114-1121, figs. 4).—Examinations made of the stomach contents of a large series of individuals showed the total bulk of food consumed in the year to be 51 per cent animal matter and 49 per cent vegetable matter. Detailed examinations showed that the animal matter contained 26.5 per cent of injurious insects and their larvae, 3.5 of neutral insects, and 2.5 of beneficial insects, 8.5 of earthworms, 6.5 of slugs and snails, 1.5 of millipedes, and 2 per cent of miscellaneous animal matter. A further inquiry into the nature of the vegetable matter showed it to consist of 20.5 per cent of cereals, 2.5 of cultivated roots and leaves, 15.5 of cultivated fruits, 7 of wild fruits and seeds of weeds, and 3.5 per cent of miscellaneous vegetable matter of a neutral nature.

"If the monthly averages are examined, we find that the percentage of animal matter is greatest in April, May, and June, the respective percentages being 65, 92, and 87. The highest percentage of fruit is found in July, August, and September, and the highest percentage of cereals in September, October, and March. In some districts the total percentage of injuries during the months July to October is nearly 100; in other words, cereals and cultivated fruits form the main items of food during this period of the year. Summarizing the above figures, we find that 36.5 per cent of the starling's food constitutes a benefit to the agriculturist, 41 per cent an injury, and 22.5 per cent is of a neutral injury. . . . A volumetric analysis of the stomach contents of 40 nestlings show that injurious insects constitute 89 per cent of the total bulk of food, neutral insects 1.5, earthworms and slugs 6.5, and miscellaneous matter 3 per cent."

Thirty-fourth report of the State entomologist, 1918, E. P. FELT (*N. Y. State Mus. Bul.* 231-232 (1920), pp. 288, pls. 20, figs. 56).—Following a brief summary of the work of the year, this report takes up the details of the work with injurious insects, including the codling moth, the European corn borer, and the Moselle wheat midge (*Cecidomyia Thecodiplosis mosellana* (Gehin). This is followed by notes as to the occurrence of other important insects during 1918. A Study of Gall Midges, VII, dealing with the tribe Itonididinae, which is a continuation of the author's monograph on the family Itonididae [Cecidomyiidae], is appended (pp. 81-240).

[Report of the] division of entomology and zoology, A. L. MELANDER (*Washington Col. Sta. Bul.* 167 (1922), pp. 24-28).—In control work with the codling moth, calcium arsenate was found to be inferior to lead arsenate, and magnesium arsenate was still less efficient. Somewhat better results were obtained with the rod and clipper nozzles than with the spray gun, the ratio being an increased protection over the unsprayed trees amounting to 7.5 times for the rod and 5.7 times for the gun. The improved spread resulting from use of ordinary laundry soap at the rate of six bars to a 200-gal. tank was not followed by greatly increased control of the codling moth. The use of the insecticide without the spreader bettered conditions 6.9 times that of the unsprayed checks, while the addition of the soap raised this figure to 7.2. One brand of lead arsenate gave three times as much protection when used at the rate of 1 lb. to 50 gal. as when used at half strength, while another brand showed little difference in effect between these two extremes.

The conclusions drawn from control work with the San José scale is that the actual strength of spray is not the only factor influencing its value as an insecticide, that scales at Clarkston and Walla Walla are more resistant than scales at Wenatchee or Yakima, that dry polysulphids are not as efficient as

the ordinary liquid lime sulphur, that oil sprays are more rapid in action than sulphid sprays, and that there is much variation in miscibility and efficiency among commercial oils. A table is given showing the variation and mortality of San José scale resulting from treatment with various insecticides at the four localities above mentioned.

In determining the effect of oil sprays upon the orchard leafroller, branches heavily infested with egg masses, collected during the winter, were sprayed and kept in the insectary until the incubation period was completed. The results in this forced development, which are reported in tabular form, show a remarkable resistance to standard sprays, there being scarcely an egg mass that did not show some eggs hatched and a number of times amounting to virtually all the eggs of the cluster. The resistance of this pest to spraying is due in part at least to the protective action of the glairy egg covering.

Some prevalent insect pests and diseases, A. FRANK (*Western Washington Sta. Bmo. Bul.*, 10 (1922), No. 2, pp. 36-38).—A brief account is given of some of the more important insect pests occurring in Washington.

Insect pests of economic plants [in the West Indies in 1920] (*West Indian Bul.*, 19 (1922), No. 2, pp. 242-257).—This is the usual annual summary (E. S. R., 46, p. 557) of the occurrence of the more important insect enemies of sugar cane, cotton, cacao, citrus, sweet potato, peanuts, coconuts, Indian corn, yams, etc., in the West Indies.

[**Economic insects in Germany**], G. LÜSTNER (*Landw. Jahrb.*, 52 (1919), *Ergänzungs.* 1, pp. 125-147, figs. 6).—In reporting upon the results of work at the Phytopathological Station at Geisenheim, mention is made of two little-known enemies of walnut, namely, the walnut tree moth (*Grazilaria roscipennella* Hüb.) and the trapezeule (*Calymnia trapezina*), of the abnormal oviposition of the grapevine mealybug (*Dactylopius vitis*), of an outbreak of the grain thrips (*Thrips cerealium*), of the pigmy mangold beetle (*Atomaria linearis*) on beet, and of serious injury to pine and hemlock produced by *Myzaphis abietina* Wlk. Mention is made of the stomach contents of the crow (*Corvus frugilegus*) and of several other birds.

[**Contributions on economic insects**] (*Ztschr. Angew. Ent.*, 8 (1921), No. 1, pp. 227, pl. 1, figs. 45; *abs. in Rev. Appl. Ent.*, 9 (1921), Ser. A, No. 12, pp. 605-614).—The papers here presented (E. S. R., 45, p. 655) relating to insects of economic importance are as follows: A Contribution to the Knowledge of the Fauna of Forest Litter; Pine Tree Litter Investigations, by S. K. Pillai (pp. 1-30); Investigations of the Simuliidae, II (E. S. R., 43, p. 51), by K. Friederichs (pp. 31-92); Contributions on the Rape Weevil (*Ceutorrhynchus assimilis* Payk.) and Its Parasite, *Trichomalus fuscatus* Thoms., by R. Heymons (pp. 93-111); How is Injury by the Pea Moth (*Grapholitha dorsana* Fab.) to be Avoided? by R. Kleine (pp. 112-118); Arsenic Salts for Combating the Codling Moth, by Herrmann (pp. 119-124); Insects Infesting Spruce Cones and Spruce Seed in Upper Bavaria, by G. Holste (pp. 126-160); Two New Chalcidids from Spruce Cones, by F. Ruschka (pp. 161, 162); The Original Habitat of the Grape Phylloxera, by C. Börner (pp. 163-167); A May Beetle Monograph; A Critical Discussion with Particular Regard to the Problem of Periodicity, by M. Zweigelt (pp. 169-176); An Alleged Fly-suppressing Material, by E. Bresslau (pp. 176-178); Formulas as an Efficient Summary of Important Biological Data on Insects, by H. Prell (pp. 179-181); The Causative Agent of Isle of Wight Disease of Bees, by O. Morgenthaler (p. 181); What is *Sulpha atrata*? by K. Friederichs (pp. 182, 183); Concerning the Injury of Leaf-cutting Ants in South America, by W. Gins (pp. 183, 184); *Hylastes angustatus* as a Pest in Silesian Pine Plantations, by F. Pax (p. 185); Opposition to a Restriction of the Use of Arsenicals in Viticulture, by K. Escherich (pp.

185-187); The Arsenic Content of Leaves, Fruits, and Wine after Spraying with Paris Green, by M. Dingler (pp. 187, 188); Urania Green in Tablet Form, by K. Escherich (pp. 188, 189); and Moth-proof Fabrics (pp. 189-191). Abstracts of economic articles follow.

Insects as disseminators of plant diseases (*Phytopathology*, 12 (1922), No. 5, pp. 225-240).—The papers presented at the joint session of the Phytopathological Society and the American Association of Economic Entomologists at Toronto, Canada, in December, 1921, are as follows: Results of Past Investigations, by F. V. Rand (pp. 225-228); Systematic Relations of Carriers, by E. D. Ball (pp. 229-231); Control Problems, by L. Caesar (pp. 231-233); and Urgent Problems of the Future, by M. W. Gardner (pp. 233-239). A list of 34 titles to the literature cited is included.

Horticultural inspection (*Jour. Econ. Ent.*, 15 (1922), No. 2, pp. 146-177, pl. 1).—The following papers were presented before the section of horticultural inspection at the annual meeting of the American Association of Economic Entomologists held at Toronto in December, 1921: Address of Chairman, by A. G. Ruggles (pp. 146-149); The Sweet Potato Inspection Service in Mississippi, by R. W. Harned and H. H. Kimball (pp. 149-158); Important Insects Collected on Imported Nursery Stock in 1921, by E. R. Sasser (pp. 158-162); A Brief Résumé of Nursery Conditions in Holland, Belgium, and France, by L. S. McLaine (pp. 162-167); The Legal Aspects of Pest Control, by S. B. Fracker (pp. 167-170); Present Status of the Gipsy Moth in New Jersey, by T. J. Headlee (pp. 170-172); and The Present Status of Entomology and Entomologists in Russia, by D. N. Borodin (pp. 172-177).

Bordeaux-oil emulsion, F. M. O'BYRNE (*Fla. Plant Bd. Quart. Bul.*, 6 (1922), No. 2, pp. 46-58).—A discussion of this insecticide and fungicide, its preparation and application. It is as effective as Bordeaux alone and as effective against scale insects as any oil emulsion.

Studies in termite control, W. C. O'KANE and W. A. Osgood (*New Hampshire Sta. Bul.* 204 (1922), pp. 3-20, figs. 8).—In this publication the authors discuss at length the control problem met with in an infestation in the basement of the administration building of a modern hospital in a New Hampshire city and the manner in which it was worked out.

In order to determine the time and the temperature required to kill, termites were inclosed in a cell in the depths of a wooden block 10 by 10 by 10 in., resembling the most favorable conditions, and the block placed in a Freas electric oven provided with thermostat control. By successive tests at graduated temperatures varying from 95 to 155° F., it was found that a temperature of 120° caused the death of all the termites in 24 hours, whereas a temperature of 95° continued for 28 hours failed to kill but 2 of 10.

Through the removal and burning of all wooden partitions and other infested material in the basement of the building, the insulation of the steam pipes, and the application of heat for a period of 24 hours, during the course of which a temperature of 140° was reached, the termites appear to have been eradicated from the building. An investigation showed the presence of termites in the soil, old apple trees, board walks, etc., in the vicinity of the hospital, and this led to additional control work for preventing the further infestation of the building.

The migratory locust (*Schistocerca peregrina* Oliv.), H. H. KING (*Wellcome Trop. Research Labs., Ent. Bul.* 12 (1921), pp. 14, figs. 7).—This is a summary of information on one of the most destructive of the insect pests which occur in the Anglo-Egyptian Sudan. This locust is a pest of arid and semiarid districts, occurring throughout the northern and central provinces of

the Sudan, but not the southern provinces, where the rainfall is heavy and the rainy season protracted.

Notes on the royal palm bug, G. F. MOZNETTE (*Fla. Plant Bd. Quart. Bul.*, 6 (1921), No. 1, pp. 10-15, figs. 3).—*Xylostodoris luteolus* Barb. has recently appeared in southern Florida and has become a serious enemy of the royal palm, this being the first record of its occurrence in the United States. The species is said to be a source of serious damage to the young growth of royal palms at Santiago de las Vegas, Cuba. Its injury is confined to the young tender leaflets as they are wrapped up in the spike and to the folded leaflets on the leafstalk as it gradually opens and spreads out. Spraying experiments have led to the recommendation that two applications at weekly intervals of 40 per cent nicotine sulphate at a strength of 1 part to 1,200 parts of water, with the addition of fish-oil soap, be applied at the rate of 5 lbs. to 125 gals. of diluted spray.

A swallowtail butterfly injurious to California orange trees (*Papilio zollicoon* Boisd.), J. R. HORTON (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 4, pp. 377-387, figs. 4).—The author records the partial or complete defoliation of nursery trees at Lindsay, Calif., by the large yellow and black caterpillars of *P. zollicoon*. Less frequently young orchard trees were the object of heavy infestation and few were entirely free from injury, as many as 50 eggs and caterpillars having been counted upon a single 1-year-old tree, and at times an entire orchard would average 15 or 20 per tree. It is said that this insect is distributed throughout the California citrus belt and annually causes a varying amount of injury to young orange trees. The caterpillar feeds almost entirely upon the tender leaves and stems of new growth, but more rarely upon the blossoms also. Due to its fondness for parsley and related plants it has sometimes been called the parsley caterpillar.

"A number of specimens reared through all their stages from egg to butterfly during the months from March to July, inclusive, required on an average of 60 days for the complete life cycle. The shortest life cycle was 43 days, the longest 84 days. The average life cycle of 61 days, as determined by adding together the figures from the rearing of separate stages, checks very closely with the foregoing."

Control measures consist in the application of arsenical sprays, to which caterpillars readily succumb. The paper includes a bibliography of 21 titles.

The occurrence and habits of *Laspeyresia conicolana* Heyl. in France, M. NÈGRE and F. PICARD (*Bul. Soc. Ent. France*, No. 1, (1921), pp. 10-12, fig. 1).—The tortricid (*Grapholitha*) *L. conicolana*, which occurs in Holland and Lower Austria where it attacks the cones of *Pinus sylvestris*, has been discovered by the authors in the forest of Saint-Guilhem le-Désert, where it attacks *P. laricio*. It has but a single generation annually, the moths appearing in April or the beginning of May. The winter is passed in the larval stage. Pupation takes place in the spring, and the moths emerge after a period of two weeks. The larvae in feeding make their way along the axis of the cone and penetrate the scales, where they pupate, their attack causing the cone to appear strongly incurved and otherwise deformed.

Chemotropism of mosquitoes, W. RUDOLFS (*New Jersey Stas. Bul.* 367 (1922), pp. 5-23, fig. 1).—Experiments were conducted by the author with freshly caught females of *Aedes sollicitans* and *A. cantator* in a laboratory near Barnegat Bay, N. J., and in the open meadows and salt marshes in that neighborhood. The results led the author to separate the substances into several classes, namely, attractive, activating merely, indifferent, and repellent.

"Perspiration, blood, urine, and sebaceous secretion (human and cow) proved unattractive. Some of their constituents and intermediate decomposi-

tion products were decidedly attractive (phenylalanin, hemoglobin). Several amino acids influenced the activity of mosquitoes or induced them to suck. Carbon dioxide and ammonia, ultimate decomposition products of the human body, proved to be strongly activating, inducing the insects to stab and to exhibit 'satisfaction' or 'pleasure.' A combination of CO_2 and NH_3 with a particular temperature and degree of moisture (such as to reproduce the conditions of the breath) was highly activating. It seems that these stimuli, produced in quantity by the human body, play an important rôle in the attraction of mosquitoes. This explains why a motionless sleeper and animals of great variety, amphibians, reptiles, birds, and mammals, are all subject to attack."

A list of 26 references to the literature is included.

Anophelism and cuniculiculture, J. LEGENDRE (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 15, pp. 600-602).—The author's observations indicate that the attraction afforded by the keeping of rabbits and guinea pigs may constitute quite an effective means of protection against malaria transmission by *Anopheles maculipennis*.

How long does a mosquito retain malaria parasites? B. MAYNE (*Pub. Health Rpts. [U. S.]*, 37 (1922), No. 18, pp. 1059-1063).—"The longest period of survival of uninfected *Anopheles* kept under artificial conditions on a diet of split dates and water, at a temperature of 45 to 75° F., was 231 days. A lot of 85 specimens of *A. punctipennis* kept without blood lived an average of 90.4 days. Eight of these were kept a period of 175 to 203 days. In mosquitoes of this species, given 1 to 3 feedings of blood previous to a diet of fruit juices, 22 specimens averaged a longevity of 100 days, and 6 specimens lived 176 to 217 days. A single specimen of *Culex territans* survived 265 days on a diet exclusively of fruit juices at a temperature of 48 to 76°.

"Plasmodia of malaria distinctly recognizable by their morphology and staining were detected in the salivary glands of five specimens of *A. punctipennis*, 68, 70, 71, 83, and 92 days, respectively, after infection. These mosquitoes had been allowed to bite a crescent carrier on a single occasion and were maintained at room temperature (59 to 83°) for 6 days, then kept in a container registering temperatures of 44 to 78° for the remainder of the experiment.

"Plasmodia of malaria proved to be viable by inoculation into a human host from the bite of a mosquito infected 55 days previously. Mosquitoes failed to convey malaria plasmodia through their biting, 61, 66, and 67 days, respectively, after becoming infected (gland sporozoites obtained). These three mosquitoes were kept under conditions identical with those in which viable sporozoites were demonstrated in the five specimens mentioned above."

A preliminary account of two serphoid (proctotrypoid) parasites of the Hessian fly, C. C. HILL (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 5, pp. 109-117).—This is an account and comparison of (*Polygnotus*) *Platygastrus vernalis* Myers and (*P.*) *P. hiemalis* Forbes, two important parasites of the Hessian fly that have been confused in this country for the same species.

On the larva and pupa of a parasitic phorid fly, *Hypocera inflascata* Mg., H. M. MORRIS (*Parasitology*, 14 (1922), No. 1, pp. 70-74, pl. 1, figs. 4).—This is an account of a species parasitic upon *Bibio marci*.

On the hypothesis that hematophagus insects are hosts of the Sarcocystis of bovines, R. SERGENT (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 27, pp. 408-411).—The author's observations support the contention of Minchin (E. S. R., 29, p. 360) and of Darling (E. S. R., 33, p. 863) that bloodsucking dipterans, i. e., tabanids and stomoxys, serve as hosts and transmit the Sarcocystis affecting bovines.

On the taxonomic value of larval characters in tachinid parasites, W. R. THOMPSON (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 4, pp. 85-93, figs. 20).—This paper deals particularly with the several varieties of *Paraphorocera senilis* Rond., a tachinid parasite of the European corn borer in southwestern France.

On the dipterous genera *Passeromyia* and *Ornithomusca*, with notes and bibliography on the nonpupiparous *Myiodaria* parasitic on birds, M. BEZZI (*Parasitology*, 14 (1922), No. 1, pp. 29-46).—This paper includes a bibliography of six pages.

The botflies of domestic animals, R. C. SHANNON (*Cornell Vet.*, 12 (1922), No. 3, pp. 240-262, figs. 11).—This is an address which summarizes the status of knowledge of the botflies.

Combating bark beetles in the cantons of Aargau and Zurich, Switzerland, in the early days of the nineteenth century, L. WEISS (*Schweiz. Ztschr. Forstw.*, 73 (1922), Nos. 3, pp. 70-80; 4, pp. 104-107).—This is a contribution to the history of forest protection and the literature on forest entomology in Switzerland.

Lady beetles of Florida, G. B. MERRILL (*Fla. Plant Bd. Quart. Bul.*, 6 (1922), No. 2, pp. 33-46, figs. 15).—In this paper brief accounts are given of the more important Coccinellidae occurring in Florida. A list of the forms collected in 1920 in Florida, as recorded in Leng's catalogue of Coleoptera (E. S. R., 44, p. 657), is appended.

The Mexican bean beetle in its bearing on Florida citrus growing, N. F. HOWARD (*Fla. Plant Bd. Quart. Bul.*, 6 (1921), No. 1, pp. 15-24, figs. 7).—This is a summary of information on *Epilachna corrupta* Muls., in which attention is called to its bearing upon the citrus industry of Florida.

Nicotin dust for control of the striped cucumber beetle, W. H. WHITE (*U. S. Dept. Agr., Dept. Circ.* 224 (1922), pp. 8, figs. 3).—The success met with by Campbell in combating *Diabrotica soror* Lec. and *D. trivittata* Mannh. in California by the use of nicotin sulphate mixed with kaolin and lime (E. S. R., 44, p. 651) led the author to conduct experiments with *D. vittata*. They were carried out at the Arlington Farm, Rosslyn, Va., during the early summer of 1921, the striped cucumber beetle being very abundant on cucurbits.

A dust containing nicotin sulphate at strengths of 4, 6, and 8 per cent, equivalent to 1.6, 2.4, and 3.2 per cent of nicotin, respectively, was used. The mixture containing 4 per cent of nicotin sulphate proved as effective as higher percentages and is recommended. The dust was found to act as a repellent as well as a contact insecticide, and when properly applied drives the insects from the cracks in the soil at the base of the plant, thereby preventing serious injury. Directions are given for preparation of the dust, which should consist of 75 per cent kaolin and 25 per cent lime. It must be applied so as to prevent the beetle from escaping by flight, and this can be accomplished by a duster that will throw a good volume of dust quickly and with force. A cheesecloth sack or a knapsack-bellows type of duster is effective on small areas.

A mixer for use in preparing small quantities of the dust is described.

Field control of the common bean weevil (*Bruchus obtectus* Say), A. O. LARSON (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 4, pp. 400-408, figs. 2).—The investigations here reported by the author are considered to justify the following conclusions:

Early beans are more susceptible to weevil injury than late ones. Beans grown on high land are more likely to be damaged by weevils than beans grown on flooded land in the same vicinity. Beans grown on sandy soil are more susceptible to weevil injury than beans grown on clay soil, and irrigated beans are no more likely to be injured by weevils than unirrigated beans.

Notes on the citrus root weevil as a strawberry pest, G. F. MOZNETTE (*Fla. Plant Bd. Quart. Bul.*, 6 (1921), No. 1, pp. 24-26, figs. 2).—The author records the attack of strawberry plants under cultivation in the vicinity of Miami, Fla., by *Pachnacus litus* Germ., hitherto referred to in literature as the citrus root weevil (*P. opalus* Oliv.).

The turnip gall weevil, P. V. ISAAC (*Jour. Min. Agr. [London]*, 28 (1922), No. 12, pp. 1130-1132, pl. 1).—This is an account of *Ceuthorrhynchus pleurostigma* Marsh., which is a source of injury to turnips and cabbage throughout the United Kingdom and also upon the Continent.

Curculios that attack the young fruits and shoots of walnut and hickory, F. E. BROOKS (*U. S. Dept. Agr. Bul.* 1066 (1922), pp. 16, pls. 8).—This is a report of observations of four species of snout beetles related to the plum curculio which attack the immature fruits, tender shoots, and leaf petioles of walnut and hickory; their distribution, food plants, nature and extent of the injury, life history, and natural enemies.

The butternut curculio (*Conotrachelus juglandis* Lec.), the food plants of which, in order of preference, are *Juglans cordiformis*, *J. sieboldiana*, *J. cinerea*, *J. regia*, *J. nigra*, and *J. mandshurica*, is first considered. This species occurs from the Provinces of Ontario and Quebec south to Alabama and Georgia, with a record of its occurrence in 20 States. The author has found this curculio attacking extensively the fruit of the native butternut (*J. cinerea*) and the shoots and leaf petioles of the Japanese walnuts (*J. sieboldiana* and *J. cordiformis*). It was found less frequently feeding and ovipositing in the shoots of the native butternut and the fruits of the Japanese walnuts. Reference is made to the extensive injury to young transplanted trees and trees in the nursery row in Connecticut, reported by Britton and Kirk (*E. S. R.*, 28, p. 553). Serious injury to young trees of *J. sieboldiana*, *J. cordiformis*, and *J. cathayensis* was observed by the author in Massachusetts, Connecticut, and New York. Southward, extensive attacks upon the fruit of the native butternut occur regularly, particularly in Maryland and West Virginia.

There is but one generation annually, the winter being passed in the adult stage. Oviposition begins in May and continues practically all summer. The eggs hatch in from 8 to 10 days. Feeding in the nuts and shoots, the larvae become full grown in 4 or 5 weeks and then enter the ground to pupate. Nearly a month is spent beneath the ground by the insect in the prepupa, pupa, and young adult stages.

The black-walnut curculio (*C. retentus* Say) is a species which commonly attacks the young fruits of black walnut in many localities in the eastern part of the United States. It occurs from Pennsylvania south to Florida. Black walnut (*J. nigra*) and butternut (*J. cinerea*) are its only known food plants. Except for its different food plants, the species corresponds very closely in all of its activities as well as in appearance with the butternut curculio.

The hickory-nut curculio (*C. affinis* Boh.) is very similar to the two species above mentioned, but it attacks the immature nuts of various kinds of hickory instead of walnuts. The species has been recorded from New Jersey southward to Florida and westward to Ohio. The dropping of the infested nuts about midsummer is said to be the most conspicuous manifestation of its presence. The nuts of the pignut hickory (*Hicoria glabra*) seem to be preferred to those of other species, although shagbark hickory nuts (*H. ovata*) are sometimes attacked extensively, and the nuts of *H. alba* and *H. minima* are attacked to some extent.

The hickory-shoot curculio (*C. aratus* Germ.), which was originally described from Kentucky in 1824 and since recorded from Massachusetts, Connecticut,

New Jersey, Florida, and Texas, as well as West Virginia, attacks the shoots of *H. minima*, *H. ovata*, *H. alba*, *H. glabra*, and *H. pecan*. No instance of serious loss has been reported, but injurious attacks, especially to newly transplanted hickory trees, are a possibility.

Methods of controlling nut-infesting curculios include the collection and burning once a week of the dropped nuts before the larvae within mature. Limited experiments by the author indicate that lead arsenate applications soon after growth starts in the spring will give good results in reducing injury, at least from the butternut and black-walnut curculios. Lead arsenate applied at a strength of 6 lbs. to 50 gal. of water has been found by Britton and Kirk to be an effective spray for controlling the butternut curculio, while Morris¹ reports that spraying with 1 lb. of lead arsenate to 10 gal. of water killed the beetles.

The cherry fruit sawfly and its control, W. P. DURUZ (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 4, pp. 393-399, figs. 5).—The cherry fruit sawfly, *Hoplocampa cooki* (Clarke), first found in California in 1883, has done considerable damage to cherries and plums in some fruit districts in the State. Its presence becomes evident from small, round holes bored in the small green fruit, many of which wither and fall. Control work has shown that it can be successfully held in check by the application of nicotin sulphate with miscible oil (Rex 35) or nicotin sulphate with lime sulphur sprayed on the trees as the blossoms are opening. The application of Nicodust is also thought an advisable treatment.

The identity of *Habrobracon brevicornis* (Wesm.), (Hym., Braconidae), R. A. CUSHMAN (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 5, pp. 122, 123).—The author finds that the *Habrobracon* parasite of the European corn borer introduced into the United States from Europe represents the true *H. brevicornis* of Wesmuel, making it necessary to use the older name, *H. juglandis* Ash., for the *Habrobracon* parasite of storage insects.

A contribution to the knowledge of the life history of some Chalcididae, J. FAHRINGER (*Ztschr. Wiss. Insektenbiol.*, 16 (1921), No. 11-12, pp. 228-235, figs. 3; 17 (1922), Nos. 1-2, pp. 7-13; 3-4, pp. 41-47).—In addition to reports of rearings, etc., this paper includes an appended table with the hosts, galls, etc., listed for 30 species.

[Papers on apiculture] (*Jour. Econ. Ent.*, 15 (1922), No. 2, pp. 121-146, figs. 3).—The following papers were presented before the section on apiculture at the annual meeting of the American Association of Economic Entomologists held at Toronto in December, 1921: Essentials of Apiary Practice and Management, by M. Pettit (pp. 121-124); The Correlation between Some Physical Characters of the Bee and Its Honey-storing Abilities, by J. H. Merrill (pp. 125-129); Time and Labor Factors Involved in Gathering Pollen and Nectar by W. Park (pp. 129-134); The Cost of Poor Queens, by F. B. Paddock (pp. 134-138); Factors Affecting the Success of American Foulbrood Campaigns, by S. B. Fracker (pp. 138-143); and Relation of Climate to Beekeeping Manipulations, by H. F. Wilson (pp. 143-146).

Nosema apis and *Acarapis (Tarsonemus) woodi* in relation to Isle of Wight bee disease, G. W. BULLAMORE (*Parasitology*, 14 (1922), No. 1, pp. 53-62).—It is pointed out by the author that the disease caused by this acarid appears to be less virulent than that which swept across the Isle of Wight in the early years of this century. It is the author's opinion that the mite will prove to be a comparatively harmless parasite in countries where two or more honey harvests and constant breeding activity are the rule.

¹ Amer. Nat. Journ., 10 (1919), No. 5, p. 71.

The insulating value of commercial double-walled beehives, E. F. PHILLIPS (*U. S. Dept. Agr., Dept. Circ. 222 (1922), pp. 10*).—The author reports upon tests made with a view to discovering any defects that may exist in the several types of double-walled hives on the market, the type of construction and insulation that gives the best results, and whether such hives have adequate insulating value for wintering bees in the North.

Temperature records show all the special hives tested to be superior to the single-walled hive in insulating value. The loss of heat was found to be most rapid through the bottom of all the insulated hives tested, and the insulation on top and sides is never used to its full capacity as so much of the heat escapes below. There was found to be relatively little heat lost through the tops of the insulated hives, and only slightly more through the insulated sides in the regular commercial double-walled hives. This is due to the ease with which heat passes through the bottoms. Air-spaced hives have less insulating value than those of the same dimensions in which the spaces are filled with insulating materials.

"The insulating value of all ordinary insulating materials depends on the air spaces confined in the material, and the insulating value is increased by increasing the number and decreasing the size of these spaces. In the so-called dead air spaces in hive construction there are doubtless convection currents within each cavity which tend to dissipate the heat. It is better to use a tray extending to the outer wall of the top collar, or to fill the collar without a tray, instead of using a tray which covers merely the top of the inner hive. If insulating material is used as a lining or cover it should be thick enough to give adequate insulation. . . .

"Attention should again be called to the fact that in these tests there were no variations due to differences in entrances, as all entrances were closed during the tests."

The European red mite, E. O. ESSIG (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 4, pp. 409-411, fig. 1*).—The author finds that the common so-called citrus red spider, which occurs in great numbers on deciduous fruit trees as well as citrus trees in California, is the European red mite. *Paratetranychus pilosus* C. and F., recent studies of which by Garman in Connecticut have been noted (*E. S. R.*, 46, p. 753). This mite has been known to occur in California since 1895, and was recorded from Oregon by Ewing in 1912 (*E. S. R.*, 28, p. 859) under the name *Tetranychus mytilaspidis* (Ril.). It is probable that the species has a wide range upon deciduous fruit trees because of the ease with which it can be carried on nursery stock. It is said to have been reported from deciduous fruit trees in Idaho by R. H. Smith.

Three new species of peculiar and injurious spider mites, H. E. EWING (*Ent. Soc. Wash. Proc., 24 (1922), No. 4, pp. 104-108*).—The author presents descriptions of *Paratetranychus heteronychus* n. sp. collected at Coachella Valley, Calif., and termed the date mite; *Eupalopsis pavoniformis* n. sp., taken in Hibiscus from Hawaii; and *Phytoptipalpus transitans* n. sp. taken from galls on *Zizyphus jujuba* from Pusa, India. The species last names represents the family Phytoptipalpidae, here erected by the author.

Fighting mites, G. R. SHOUP (*Western Washington Sta. Bimo. Bul., 10 (1922), No. 2, pp. 38-42, figs. 2*).—This is a brief summary of information.

Notes on acarine disease, X-XII, J. RENNIE (*Bee World, 3 (1922), Nos. 9, pp. 219-221, figs. 2; 10, pp. 237-239, figs. 6, 11, pp. 262, 263*).—In continuation of papers previously noted (*E. S. R.*, 46, p. 858), the author presents notes on the region of invasion by *Acarapis woodi*, examination of bees for diagnosis, analytical considerations, criteria of death in *A. woodi*, the vitality of *A. woodi*, summary of examinations, etc.

A. woodi is unquestionably a true endoparasite, and the author believes this is the only case of the kind known among acarines, although he considers it is more than probable that future investigation will reveal other instances of a similar nature.

The fowl tick (*Argas persicus* Oken), H. H. KING (*Wellcome Trop. Research Labs., Ent. Bul. 16 (1921), pp. 6*).—This is a brief summary of information on the fowl tick in which particular attention is given to protective measures.

Tularaemia Francis 1921.—VII, Six cases of tularaemia occurring in laboratory workers, G. C. LAKE and E. FRANCIS (*Pub. Health Rpts. [U. S.], 37 (1922), No. 8, pp. 392-413, figs. 2*).—In this continuation of the papers previously noted (*E. S. R., 46, p. 662*), the authors report on the occurrence of this disease in persons who had been engaged in the laboratory in handling or dissecting rodents infected with the Utah strains of *Bacterium tularensis*.

Tularaemia Francis 1921: A new disease of man, E. FRANCIS (*Jour. Amer. Med. Assoc., 78 (1922), No. 14, pp. 1015-1018*).—A general summary of information of this disease in man, accounts relating to which have been previously noted (see above).

Tularaemia Francis 1921 developing in a laboratory worker, J. J. O'MALLEY (*Jour. Amer. Med. Assoc., 78 (1922), No. 14, pp. 1018-1020, fig. 1*).—This is the report of a case of tularaemia in a laboratory worker.

FOODS—HUMAN NUTRITION.

Twenty-sixth report on food products and fourteenth report on drug products, 1921, E. M. BAILEY (*Connecticut State Sta. Bul. 236 (1922), pp. 231-300*).—The inspection work reported has included principally soft drinks, milk, ice cream, fats and oils, oysters, tea, vinegar, diabetic foods, etc.

With respect to some of the diabetic foods the author notes that "breads made from cottonseed-wheat, almond-gluten, and soy bean flours for our own experimental purposes were made according to recipes suggested by others and do not represent in any way specific suggestions on our part for diabetic dieters. The soy bean bread was, however, particularly palatable, and the analysis shows a low content of available carbohydrate. The glucose yield of soy bean protein in metabolism has not been determined so far as we know, but assuming it to be equal to that of wheat protein it would require about 2 parts of this bread to yield the same amount of glucose in metabolism as 1 part of ordinary wheat bread, according to Janney's method of comparison."

In connection with the diabetic food studies, analyses were made of dried dahlia tubers, which had the following percentage composition: Water 2.13, protein 19.5, fat 1.35, nitrogen-free extract 60.5, crude fiber 8.55, and ash 7.97 per cent. Of the material in the nitrogen-free extract, 1.68 per cent was found to be soluble in hot water, before hydrolysis, as levulose, 49.15 per cent soluble in hot water, after hydrolysis, as inulin (calculated from levulose assuming the factor 0.9), and 4.92 per cent as dextrose upon direct acid hydrolysis of the water-insoluble residue.

A report of studies on the cryoscopy of milk (pp. 251-271) is noted on page 505 of this issue. An abstract of a report on the determination of caffeine in tea by R. E. Andrew as referee on tea, presented at the 1921 meeting of the Association of Official Agricultural Chemists, is also included (pp. 276-282).

Digestibility of cod-liver, Java-almond, tea-seed, and watermelon-seed oils, deer fat, and some blended hydrogenated fats, H. J. DEUEL, JR., and A. D. HOLMES (*U. S. Dept. Agr. Bul. 1033 (1922), pp. 15*).—Continuing earlier

work (E. S. R., 45, p. 62), digestion experiments are reported from which the following coefficients were obtained:

Coefficients of digestibility of various oils and fats.

Kind of oil or fat	Melting point.	Digestibility	Kind of oil or fat.	Melting point.	Digestibility.
	° C	Per cent		° C	Per cent.
Cod-liver oil.....	...	97.7	Blended hydrogenated fats	...	...
Java-almond oil.....	...	97.0	Cottonseed fat.....	41.3	96.6
Tea-seed oil.....	...	91.2	Do ..	45.8	96.4
Watermelon-seed oil.....	...	94.8	Do ..	47.8	94.2
Deer fat.....	51.4	81.7	Do ..	48.1	94.4
Blended hydrogenated fats	...	...	Do ..	50.0	87.0
Corn fat.....	39.0	95.2	Peanut fat.....	43.0	96.6
Do.....	49.0	93.3	Do ..	43.2	97.4
Do.....	54.0	91.5	Do ..	51.1	92.8

In general, the results agreed with the earlier investigations. As regards the blended hydrogenated vegetable oils, no physiological disturbances were apparent when they were eaten in relatively large quantities. From the data available it appears that the digestibility of these blended fats compares favorably with that of the natural fats of like melting points.

Mold formation in meat kept in cold storage. A. MONVOISIN (*Rec. Méd. Vét.*, 98 (1922), No. 5, pp. 149-161, figs. 5).—This is a general discussion of mold formation on cold-storage meat, based on observations made by the author and on the paper of Brooks and Kidd (E. S. R., 46, p. 860). It is thought that other fungi than *Cladosporium herbarum* may also be involved in the so-called black spot. The molds most frequently found on meat are in order of their importance *Thamnidium elegans*, *Mucor mucedo*, *Rhizopus nigricans*, *Penicillium glaucum*, and *C. herbarum*.

The preservation of fish frozen in chilled brine.—II, The keeping quality of the fish. L. H. ALMY and E. FIELD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 3, pp. 203-206).—This paper concludes the investigation previously noted (E. S. R., 46, p. 664) by a study of the keeping quality of fish frozen in 15 per cent brine solution as compared with those frozen in air at -10° C. The former were found to gain slightly in weight and the latter to lose weight on freezing. Subsequent storage led to a greater loss in weight in air-frozen than in the brine-frozen fish. It was found possible to obtain a satisfactory glaze in brine-frozen fish by rinsing them in cold water and holding them in storage for 12 hours. At the end of the maximum holding period the surface of the brine-frozen fish presented a fresher and more attractive appearance than that of the air-frozen fish.

No pronounced difference could be noted in the percentage of fat-free solids, ammonia, and amin nitrogen in the same kind of fish, frozen in the two ways, nor was there any difference in the rate of decomposition of the fish. There was also very little choice between the two methods from the standpoint of bacterial decomposition during storage.

What is self-rising flour? B. R. JACOBS (*Northwest. Miller*, 130 (1922), No. 8, pp. 829, 830, figs. 2; also in *Amer. Food Jour.*, 17 (1922), No. 5, pp. 9-11, figs. 2).—A brief report is given of the results of an examination of 37 samples of self-rising flour purchased in the open market in the South. The examination consisted in determining the class and grade of flour used, the amount and character of the leavening agents, and the baking qualities.

Practically all of the flours examined were made from soft wheat. Many contained less than 9 per cent and none over 11 per cent gluten. More than 25 per cent of the samples contained quantities of offal material in excess of those usually found in straight grade flour.

In many cases the flour contained an excess of calcium acid phosphate and in others an excess of sodium bicarbonate, while in some others there was an insufficient amount of sodium bicarbonate. The baking tests corroborated the results of the chemical tests. Biscuits made from the self-rising flours of inferior grades were poor in color and flavor. Those made from flour containing a deficiency and an excess of carbonate yielded biscuits that were, respectively, low in volume and of a yellow color.

"The results of this investigation justify the conclusion that regulation in the manufacture of self-rising flour is essential as a health measure, as a food product is being made and consumed which is deficient in certain essentials and which if continued may have a detrimental effect on public health. It would also justify the adoption of standards of purity of wheaten flour and of the leavening ingredients used in the manufacture of self-rising flours, as well as the adoption of maximum limits of the amount of these leavening ingredients and of residual carbon dioxide and minimum limits of the amount of available carbon dioxide necessary to properly aerate the baked product."

Heights and weights of school children, T. CLARK, E. SYDENSTRICKER, and S. D. COLLINS (*Pub. Health Rpts. [U. S.], 37 (1922), No. 20, pp. 1185-1207, figs. 9*).—This is a statistical study of the heights and weights of 14,335 white children of native parentage in representative localities in Maryland, Virginia, and North and South Carolina. The observations were limited to children from 6 to 16 years of age, inclusive, who were actually attending school. The data are presented and discussed under the topics mean heights and weights, difference in heights and weights of children of the same sex and age, and correlation of height and weight. The principal conclusions drawn from the data presented are summarized as follows:

"The mean heights of the girls 11 to 14 years of age, inclusive, and the mean weights of the girls 12 to 14 years, inclusive, are greater than those of the boys of the same ages. At the other ages studied the boys are taller and heavier than the girls. The weight-height index (weight per inch of height) of the girls exceeds that of the boys from 12 to 14 years and is equal at 15 years. At the other ages studied it is greater for boys than for girls.

"The annual increment in weight of the girls exceeds that of the boys from 8 to 13 years, inclusive. At the other ages studied it is greater for boys. However, when the annual increment in weight per inch of increment in height is considered, it is found greater for girls than boys at every age after 6, except 10 years.

"Variations in height and in weight differ markedly for different sex-age groups and are closely associated with the rate of increase in weight. When variation in weight is considered independently of variation in height, the boys 14 to 16 years of age vary considerably more in weight than the girls of the same age. But when the effect of variation in height is eliminated, the girls vary more in weight than the boys of the same age at all ages above 8 years. In other words, girls after 8 years of age vary more in weight than boys of the same age and height.

"Correlation between heights and weights was found to be lower for the girls than for the boys at all ages above 8 years and markedly lower after 13 years of age."

The final results of the study are presented in tables giving the average weights of the boys and girls of each age by height groups. These figures were obtained by computing the mean weights for children at each year of age and at each inch of height. From these data smoothed averages were obtained by the method of least squares.

It is suggested that these tables might serve as standards of weight for such children in the South.

Gaseous exchange and physiological requirements for level and grade walking, H. M. SMITH (*Carnegie Inst. Wash. Pub. 309 (1922), pp. VIII+310, pls. 2, figs. 41*).—This report presents the results of a series of experiments carried out in continuation of an investigation at the nutrition laboratory of the Carnegie Institution on the energy expenditure during work. The special work studied in this research was that of grade walking, in connection with which observations were made with the subject walking on a level, these observations supplementing the previous data obtained by Benedict and Murschauser on energy transformations during horizontal walking (*E. S. R.*, 34, p. 260). Additional data were obtained on the changes in the pulse rate, respiration rate, pulmonary ventilation, and body temperature as affected by the intensity of the work in both horizontal and grade walking and their relation to the energy expended.

The report includes a critical review of the literature on the subject, a detailed description of the plan of the investigation and the apparatus employed, much of which was described in the study of Benedict and Murschauser, the statistical data obtained, and a detailed discussion of these data in the general order of standing, horizontal walking, and grade walking experiments, considering first in each case the gaseous metabolism and heat output and then the physiological effects of the work performed. Eight subjects were used in the entire investigation, although most of the data were obtained with two only.

The average standing metabolism for the eight subjects was 1.18 calories per kilogram of body weight per hour, which represents an increase of 12 per cent for the standing over the lying position. With the standing requirements as a basis, the increase in energy output for horizontal walking above that for standing varied for the eight subjects from 0.454 to 0.618 gram-calories for each horizontal kilogram-meter, and for the two subjects with whom most of the work was done the increase was 0.490 and 0.478 gram-calories, respectively. The total energy expended per meter increase in speed was not measurably affected until a speed of 80 meters per minute was reached, beyond which each meter increase in speed required a proportionately greater increase in energy consumption.

In grade walking the energy expended was from 15 to 12 gram-calories per kilogram-meter for work ranging from 300 to 600 kilogram-meters per minute, and from 12 to 10 gram-calories when the work was between 1,000 and 1,500 kilogram-meters per minute. The average increase in the heat output due to grade walking was 7.5 gram-calories per kilogram-meter of work performed.

The increase in pulmonary ventilation during grade walking was from 3 to 5 liters for each increase of 100 kilogram-meters of work, and the total percentage increase with excessive work amounted to as much as 850 per cent above the standing requirement.

The respiration rate showed a constant increase over the standing value of 1.2 respirations in one case and 2 in another for each kilogram-meter increase in work when over 500 kilogram-meters of work was done.

The pulse rate was frequently less in horizontal walking than with the subject standing, but in grade walking showed a practically uniform increase with the increase in the amount of work performed. The body temperature showed increases as high as 2° C., indicating a storage of heat in the body of approximately 100 calories per 60 kg. of body weight.

“From the measurements taken at the time of transition from standing to grade walking, it is believed that in most cases the body adjusts itself to the new demands as to pulse, respiration rate, pulmonary ventilation, and oxygen

supply by the end of the third minute, and by far the larger part of the adjustment has occurred within 30 seconds. The recovery after exercise, however, is not so prompt, and the after-effects of the walking persist for a much longer time before initial conditions are reestablished."

Synthesis of amino acids in animal organisms.—I, Synthesis of glycocoll and glutamin in the human organism, G. J. SHIPLE and C. P. SIERWIN (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 3, pp. 618-624).—In this investigation a human subject was maintained on a diet of cream, bananas, and starch or lactose for four days, after which benzoic acid, phenylacetic acid, benzoic and phenylacetic acids, and phenylacetic acid were administered on successive days. The benzoic acid was given in two 3-gm. amounts at an interval of 6 hours, the phenylacetic acid in two doses of 3.3 gm. each at intervals of 12 hours, and two acids together in a single dose of 3.3 gm., and in the last test the phenylacetic acid in doses of 4 and 6 gm. at an interval of 8 hours. The urine was collected at the end of definite periods of time and analyzed for total, urea, ammonia, creatinin, glycocoll, and glutamin nitrogen.

The data obtained showed that urea during the control period maintained an average of 44 to 77 per cent, while during the acid-feeding periods it dropped to 60, 57, 48, and finally to 28 per cent of the total nitrogen of the entire 24-hour period, and on one occasion to the extremely low value of 12 per cent of the total nitrogen. This is thought to indicate that not only glycocoll but glutamin is synthesized at the expense of urea. The ammonia and creatinin nitrogen were unaffected by the acid ingestion.

The value of gelatin in relation to the nitrogen requirements of man, R. ROUSON (*Biochem. Jour.*, 16 (1922), No. 1, pp. 111-130, (fig. 1)).—This paper presents a critical review of the literature on the problem of the utilization of gelatin as a source of nitrogen in human and animal nutrition, followed by the report of an attempt to obtain more light on the problem by direct experiments on man. The plan of the investigation consisted in supplementing a basal nitrogen-free diet for 10-day periods with low, medium, and large amounts of gelatin to determine whether the minimum nitrogen loss on an abundant nitrogen-free diet can be still further reduced by gelatin, and if so, what relation the amount of this reduction bears to the amount of gelatin ingested.

On the nitrogen-free diet not supplemented by gelatin the average nitrogen balance for 3 days was -2.89 gm. On this diet supplemented by 12.488, 4.85, and 7.54 gm., respectively, of nitrogen furnished by gelatin the nitrogen balance was -2.70, -2.59, and -3.20, respectively.

In interpreting these results in terms of actual saving of body nitrogen, two methods have been used. In the first it has been assumed that the minimum nitrogen requirements are represented by the sum of the nitrogen in the urine and in the feces on the nitrogen-free diet, and that the difference between the latter amount and the corresponding excretion on the gelatin diets represents unabsorbed gelatin nitrogen. In the second it has been assumed that the gelatin is completely absorbed, and that the minimum requirements are represented by the output in the urine on the nitrogen-free diet plus the nitrogen in the feces on the gelatin diet under consideration. The figures obtained by McCollum in his investigation of the sparing action of gelatin, using pigs as experimental animals (*E. S. R.*, 26, p. 359), are also calculated in the same way. The saving in terms of the nitrogen minimum as calculated by these two methods is as follows: On the low gelatin diet 11.9 and 15.9 per cent of the minimum body nitrogen saved, on the medium gelatin diet 0 and 5.3, on the high nitrogen 8.1 and 14.7, and from McCollum's results with pigs 36.1 and 36.3 per cent, respectively.

In discussing these results it is pointed out that the fact that the maximum saving in terms of the nitrogen minimum was obtained with the lowest amount of gelatin appears to prove that the effect is not due to any impurity in the gelatin. "In this connection, however, the possibility that the increased protein in the diet entails an increased loss of body nitrogen must not be overlooked, although the creatinin excretion does not lend any support to such a hypothesis." The discrepancy between the results obtained in the present investigation and those found by McCollum is attributed to a difference in the metabolism of man and pig. On comparing the results obtained in terms of the amounts of creatinin excreted in the several experiments, the ratio of the nitrogen balance to the average amount of creatinin was practically the same in all cases. The general conclusion drawn as a result of this investigation is that the action of gelatin consists essentially in the reduction of the waste of amino acids derived from the body protein through deamination and subsequent oxidation in the body.

Distribution of the nitrogenous constituents of the urine on low nitrogen diets, R. ROBISON (*Biochem. Jour.*, 16 (1922), No. 1, pp. 131-133).—Data are presented on the nitrogen distribution in the urine of two subjects subsisting for 3 and 4 days, respectively, on a diet furnishing only about 0.3 gm. of nitrogen, and of the same subjects for 4 and 5 days following on the same basal diet with the addition of sufficient milk to bring the nitrogen intake to about 3 gm.

The results obtained were in complete agreement with those previously reported by Polin in a similar study (*E. S. R.*, 17, p. 166). The creatinin nitrogen was practically constant for each individual, 7.3 and 8.2 mg. per kilogram of body weight, respectively. The values of total and urea nitrogen were very low, the latter falling in one case to 37 per cent of the total nitrogen.

The content of zinc in the organs of the rabbit and other vertebrates, G. BERTRAND and R. VLADESCO (*Bul. Soc. Chim. France*, 4. ser., 31 (1922), No. 3, pp. 268-272).—The authors' studies on the content of zinc in the various organs of different animals (*E. S. R.*, 46, p. 687) have been extended to determinations of zinc in various organs of the rabbit and in the muscle tissue of calves, cattle, sheep, pigs, eels, and flounders. Whole eggs, egg white, and egg yolk have also been analyzed for zinc.

The data obtained confirm the conclusions previously drawn in the study of the content of zinc in the horse (*E. S. R.*, 45, p. 307) in regard to the constant presence of this element, its distribution in the various organs, and its quantitative variation.

The general conclusions drawn from this and previous studies are that the organs of birds are richer in zinc than those of mammals and perhaps of fish. The larger organs contain about 20 to 40 mg. of zinc per kilogram of fresh substance in mammals and fish and about double that in birds.

Zinc in hen's eggs was found to be located practically entirely in the yolk, a content of 1.4 mg. per 100 gm. being found in three cases. It is pointed out that manganese and iron are also located in the yolk rather than in the white of the egg.

Bacterial nutrition: Growth of a hemophilic bacillus on media containing only an autoclave-stable substance as an accessory factor, T. M. RIVERS (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 374, pp. 149-151).—A hemophilic bacillus (*Bacillus hemoglobinophilus cantis*) has been found which does not appear to require the heat-labile factor previously found necessary for the growth of hemophilic bacilli (*E. S. R.*, 46, p. 79). This is thought to throw doubt on any theory of interaction between the heat-labile and heat-stable

factors in the growth of hemophilic organisms, as has been suggested by Thjötta and Avery, Eldes, and Davis (E. S. R., 46, pp. 78, 79, 80).

Vitamin requirements of *Drosophila*.—I, Vitamins B and C, A. W. BACOT and A. HARDEN (*Biochem. Jour.*, 16 (1922), No. 1, pp. 148-152).—Evidence is presented that the complete development of *Drosophila* requires the presence of vitamin B but not of vitamin C. No definite result with vitamin A has as yet been obtained, but the preliminary results indicate that the fly is able to develop in the presence of very small amounts of this vitamin if not in its entire absence.

The action of yeast-growth stimulant, O. K. WRIGHT (*Biochem. Jour.*, 16 (1922), No. 1, pp. 137-142).—To determine the nature of the yeast-growth stimulant, a series of 10 tubes was prepared with Williams' mineral nutrient solution (E. S. R., 41, p. 670), and another series with the same solution without the ammonium sulphate. To the tubes were then added varying percentages of lemon juice neutralized by the method of Harden and Zilva and sufficient water to make up the volume to 10 cc. The tubes were sterilized by steaming for 30 minutes on each of three successive days and then inoculated with a loopful of pure yeast emulsion containing from 50 to 500 cells, aerated, and incubated at 25° C. The number of cells were counted each day by a Thoma hemacytometer. A similar series of experiments was carried out using increasing amounts of the Osborne and Wakeman yeast extract (E. S. R., 42, p. 314).

In both series of experiments it was found that the rate of growth of the yeast was at first independent of the ammonium sulphate and dependent upon the concentration of bios. When the yeast had reached a concentration of about 5 or 6 million cells per cubic centimeter, the growth was more rapid in the presence than in the absence of ammonium sulphate. The yeast extract was about ten times as effective as the lemon juice, although its nitrogen content was more than thirty times as great.

Conditions of inactivation of the accessory food factors, S. S. ZILVA (*Biochem. Jour.*, 16 (1922), No. 1, pp. 42-48).—This is the complete report of an investigation previously noted from preliminary reports (E. S. R., 45, p. 565).

The activity of cod liver oil as a source of vitamin A was destroyed by exposing the oil to ozone in the dark and by bubbling air through it for 18 hours at 120° C. The activity of autolyzed yeast in vitamin B was not destroyed by shaking it with ozone, but decitrated lemon juice lost its antiscorbutic properties on similar treatment and also when air was passed through the solution at ordinary temperatures. Ultraviolet rays in the absence of air did not destroy the activity of these substances. Decitrated lemon juice boiled for 2 hours in an atmosphere of carbon dioxide did not lose its activity, but became almost entirely inactive after boiling for an hour in the presence of air. Hydrolysis of decitrated lemon juice with hydrochloric acid for 5 hours impaired but did not entirely destroy the antiscorbutic activity of the juice.

Studies on experimental rickets.—X, Rickets and rickets-like disease produced in rats by deficient diets, P. G. SHIPLEY, E. A. PARK, E. V. MCCOLLUM, and N. SIMMONDS (*Dental Cosmos*, 64 (1922), No. 3, pp. 265-273, figs. 9).—This is chiefly a description of the histopathological changes induced in rats by the various deficient diets described in the first paper of the series (E. S. R., 45, p. 368).

Studies on experimental rickets.—XII, Is there a substance other than fat-soluble A associated with certain fats which plays an important rôle in bone development? E. V. MCCOLLUM, N. SIMMONDS, P. G. SHIPLEY, and E. A. PARK (*Jour. Biol. Chem.*, 50 (1922), No. 1, pp. 5-30, pl. 1, figs. 16).—Further evidence in support of the theory that cod liver oil contains a substance capable

of exerting a favorable influence on bone growth which is distinct from vitamin A (E. S. R., 46, p. 472) is presented in a series of records of groups of rats which were fed throughout the period of growth and into maturity on diets deficient in calcium and containing in some cases butter and in others cod liver oil.

On such a diet the animals receiving 1 per cent of cod liver oil showed better growth, fertility, success in rearing young, and longer life than those receiving from 10 to 20 per cent of butter fat. On increasing the calcium content of the diet, the difference between the effects of butter fat and cod liver oil tended to disappear.

"The results of this series of experiments were so consistent and decisive that we can deduce no other conclusion than that cod liver oil contains in abundance some substance which is present in butter fat in but very slight amounts, and which exerts a directive influence on the bone development and enables animals to develop with an inadequate supply of calcium much better than they could otherwise do. This substance is apparently distinct from fat-soluble A, which is essential for growth and which is associated definitely with the prevention of ophthalmia (keratomalacia)."

The prevention of the development of rickets in rats by sunlight.—XIV, Studies on experimental rickets, G. F. POWERS, E. A. PARK, P. G. SHIPLEY, E. V. MCCOLLUM, and N. SIMMONDS (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 3, pp. 159-165, figs. 5).—This is a complete report of the investigation previously noted (E. S. R., 47, p. 67), together with a review of the literature on the action of light in the cure of rickets and tetany.

Heliotherapy and rickets (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 3, pp. 195, 196).—An editorial review and discussion of the above and other papers on the subject.

Studies on experimental rickets.—XV, The effect of starvation on the healing of rickets, E. V. MCCOLLUM, N. SIMMONDS, P. G. SHIPLEY, and E. A. PARK (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 371, pp. 31-33, pl. 1).—It is reported that when young rats with rickets are made to fast, except for water, for periods of from 3 to 5 days deposition of calcium salts in the cartilage of the bones begins in exactly the same manner as when suitable amounts of cod liver oil are given. In attempting to explain these results, it is suggested that the healing of rickets by starvation may be due to a selective tissue decomposition, with a resulting increase in the circulating blood of the substance required for the proper calcium-phosphate ratio. The particular diet used in this investigation was one characterized by a low content of phosphorus and vitamin A and a great abundance of calcium.

Studies on experimental rickets.—XVI, A delicate biological test for calcium-depositing substances, E. V. MCCOLLUM, N. SIMMONDS, P. G. SHIPLEY, and E. A. PARK (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 41-49, pls. 2, fig. 1).—This paper describes in detail the biological test suggested in an earlier paper of the series (E. S. R., 45, p. 368) for determining the calcium-depositing power of any substance in terms of cod liver oil units. The diet finally selected as most suitable for the purpose consisted of whole wheat kernel 33, whole maize kernel 33, gelatin 15, wheat gluten 15, NaCl 1, and CaCO₃ 3 parts. This diet furnishes abundant proteins of good quality, a low content of phosphorus (0.3019 per cent), a high content of calcium (1.221 per cent), and a low content of vitamin A. Young rats which have grown rapidly to about 55 to 60 gm. are confined to this diet for a period of about 35 to 40 days, after which some of the animals are given the substance to be tested and others are continued on the basal ration. The animals and controls are killed and autopsied at the end of a designated time.

It is stated that this diet uniformly causes the bones of the animals fed on it to be free from calcium as regards the epiphyseal cartilages and the metaphyses. The reappearance of the provisional zone of calcification after the addition of any substance to the rickets-producing diet constitutes the so-called "line test" for the calcium-depositing power of the substance. As thus tested, cod liver oil to the extent of 2 per cent by weight of the diet causes the provisional zone of calcification to be reformed in 5 days.

It is emphasized that both test and control animals must be kept under the same conditions of illumination, and since, as noted above, starvation causes redeposition of calcium in the bones, records of the food consumption must be kept during the experiment.

Studies on experimental rickets.—XVII, The effects of diets deficient in calcium and in fat-soluble A in modifying the histological structure of the bones, E. V. McCOLLUM, N. SIMMONDS, M. KINNEY, P. G. SHIPLEY, and E. A. PARK (*Amer. Jour. Hyg.*, 2 (1922), No. 2, pp. 97-106, pls. 7).—In this paper are described in detail the pathological conditions produced in rats by a diet consisting of wheat 30, maize 30, polished rice 10, rolled oats 10, peas 10, and navy beans 10 parts, and by the same diet with the addition of sodium chlorid and bicarbonate. These diets are deficient in calcium, vitamin A, and "a second dietary essential associated with certain fats, notably cod liver oil, provided this latter factor is a distinct entity." The first diet is deficient to a minor extent in sodium, chlorine, and phosphorus, and the latter in phosphorus. While these diets did not produce a constant pathological condition, the variations were of a qualitative rather than a quantitative nature, and the condition of the animals upon either diet was considered to be of a rachitic nature.

[**Studies on experimental rickets.—XVIII, Is there more than one kind of rickets?** P. G. SHIPLEY, E. A. PARK, E. V. McCOLLUM, and N. SIMMONDS (*Amer. Jour. Diseases Children*, 23 (1922), No. 2, pp. 91-106, figs. 11; also in *Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 4, pp. 149-154).—The authors advance the suggestion, based on clinical observations and the studies above noted that there are two main kinds of rickets, one characterized by a normal or nearly normal blood calcium and a low blood phosphorus, and the other by a normal or nearly normal blood phosphorus but a low blood calcium. It is thought that, in the absence of certain active light rays and an unidentified dietary factor contained in cod liver oil, any influence resulting in the decrease of the calcium or phosphate ions in the body fluids with the formation of calcium-phosphate ratios favorable to the development of rickets would ultimately produce the disease. A description is given of the pathological condition induced in rats by low phosphorus and low calcium diets under the conditions noted above, and a discussion is included of the relation of tetany to rickets. "Tetany is essentially an expression on the part of the nervous tissues of an insufficiency of the calcium ion. Rickets is essentially an expression on the part of the skeleton of disturbed relations between the calcium and phosphate ions of the body fluids."

Study on experimental rickets.—XIX, The prevention of rickets in the rat by means of radiation with the mercury vapor quartz lamp, G. F. POWERS, E. A. PARK, P. G. SHIPLEY, E. V. McCOLLUM, and N. SIMMONDS (*Bul. Johns Hopkins Hosp.*, 33 (1922), No. 37½, pp. 125-127, pl. 1).—Previously noted from a preliminary report (*E. S. R.*, 46, p. 869).

Rickets: A theory of the metabolic disturbances and of its association with tetany, D. N. PATON (*Brit. Med. Jour.*, No. 3193 (1922), pp. 379-381).—The literature on the etiology of rickets, particularly with reference to phosphoric acid as the possible limiting factor in ossification in rickets, is reviewed.

The theory is advanced that "an error in the metabolism of lecithin, probably in the liver, may be a causal factor in the failure of bone formation in rickets, and that this faulty metabolism may in some cases be accompanied by an increased conversion of cholin into guanidin compounds, thus explaining the association of tetany with rickets."

Studies in experimental scurvy, with special reference to the antiscorbutic properties of some South African foodstuffs, E. M. DELF (*Lancet* [London], 1922, I, No. 12, pp. 576-579).—This is an abstract of the report of an investigation, carried out at the South African Institute for Medical Research, Johannesburg, of the relative antiscorbutic values of the foodstuffs commonly in use in the dietary of native workers in the Rand mines. Various fruits and vegetables native to South Africa were studied for their antiscorbutic properties by the methods employed at the Lister Institute, London, guinea pigs being used as the experimental animal, with oats, bran, and fresh milk autoclaved at 120° C. for one hour as the basal ration.

The minimum protective dose of the juice of navel oranges was found to be 1.5 cc. daily. Of peaches, from 2 to 3 cc. afforded protection early in the season, but as the peaches ripened they proved less effective. The minimum protective dose of pineapple juice is placed at 2.5 cc., representing 9 gm. of the whole fruit, the native naartje or tangerines 1.5 cc., and the papaya (*Carica papaya*) 5 cc. of the juice or 10 gm. of the fresh fruit. The minimum protective dose of the juice of the pumpkin was from 15 to 20 cc., or from 75 to 100 gm. of the raw vegetable. The results obtained with vegetable marrow were inconclusive, although the juice of the young green marrow was more active than that at the end of the season. The minimum protective dose of sweet potato juice was between 4 and 5 cc., or 13 gm. of the raw vegetable. No antiscorbutic value could be detected in the fresh juice of the sugar cane.

Of raw germinated cowpeas (*Vignum sinense*), a daily ration of 2.5 gm. was found sufficient to protect guinea pigs against scurvy for nearly 90 days. Germinated soy beans had no, and germinated kafir only slight, antiscorbutic properties. Various attempts were made to cook cowpeas in such a way that they would be softened without losing their antiscorbutic properties. The most satisfactory method proved to be steaming over water to which a small amount of ammonium carbonate, 0.5 gm. to the liter, had been added, or cooking them in a double boiler in a small amount of water to which a little ammonium carbonate had been added, the cooking water also being used.

In experiments with monkeys, native kafir beer was found to have an antiscorbutic value slightly less than that of fresh milk, the value apparently varying with the amount of malt used in the brewing.

In a number of curative experiments which are not reported in detail, the juice of the papaya was found to have unexpectedly good results, especially in cases of severe scurvy accompanied by scorbutic dysentery.

The recommendations made as a result of this study are that the miners be given a regular ration either of fruit such as oranges, pineapples, and tangerines, when these are in season, or of vegetables such as sweet potatoes when fruits are not available. It is emphasized that vegetables should be cooked as little as possible.

ANIMAL PRODUCTION.

Hormones and heredity, J. T. CUNNINGHAM (London: Constable & Co., Ltd., 1921, pp. XX+246, pls. 3, figs. 9).—This book gives a discussion of the relations between hormones, or internal secretions, and recent investigations in Mendelian heredity and mutations. Proof is presented showing the importance of hormones in heredity, giving many examples taken from the

literature as a basis. Much of the proof is approached from the viewpoint of the evolution of the different organs and characters involved. Somatic modification is said to occur by means of external stimuli, and hormones are produced which act on the germ cells and thus the modification becomes inherited. This does not conflict with the present mutation theory, since modifications may also originate in the germ cells.

It may thus be seen that the conception of hormones and heredity is presented as a supplement to the present idea of the mechanism of heredity. The author states in his conclusions that "heredity or constitutional factors are of course of the highest importance, but there exists very good evidence that modifications due to external stimulus do not perish with the individual, but are in some degree handed on to succeeding generations, and that good qualities and improvement of the race are not exclusively due to mutations which are entirely independent of external stimuli and functional activity. It is important to produce good stock, but it is also necessary to exercise and develop the moral, mental, and physical qualities of that stock, not merely for the benefit of the individual but for the benefit of succeeding generations."

Department of genetics.—General statement, C. B. DAVENPORT (*Carnegie Inst. Wash. Yearbook 20 (1921), pp. 101-152, figs. 4*).—A brief account is given of the genetics experiments which were being carried on during 1921 at the Cold Spring Harbor laboratory. Among those having a direct relation to animal genetics are the following: Studies of the relationship between chromosome number and specific variation in form and other characters; the production of hybrids between two forms of domestic mice which were more active, sturdy, and intelligent than either of the parental races; the heredity of susceptibility, and resistance to the growth of tumors in rats and man; demonstrations that the sex determiner apparently does not lie in similar chromosomes in closely related species of *Drosophila*; evidence that male and female embryos of pigeons are different in their metabolism; a study of mammalian spermatozoa, showing that unlike those of some insects they do not fall into two types in respect to size; studies of the inheritance of the capacity for successful transplantation of tissue from one individual to another; evidence that in white cats the gametes carry lethal factors which operate even in the simplex condition; studies of the heredity of intelligence in dogs and man; evidence of nondisjunction in the fourth chromosome of *Drosophila*; the completion of a quantitative study of the inheritance of musical ability, bringing evidence of its Mendelian behavior; evidence that abnormalities in development of pigeon embryos are often due to endocrine disfunctioning of the mothers; the elaboration of tables for predicting probable future egg production in the fowl from its fecundity at any time; studies in the effects of alcohol on size of litters and growth of rats; proof that in swine at least the migration of ova from one ovary through the body cavity to the opposite tube is rare; heredity of twinning in sheep; direction of whirling in waltzing mice; and modification of the Mendelian ratio in *D. melanogaster* by selection.

The location of a new second chromosome eye color gene in *Drosophila melanogaster*, G. H. M. WAALER (*Hereditas, 2 (1921), No. 3, pp. 391-394*).—In crossing a female heterozygous for eosin and vermilion eye color, and forked bristles with an eosin-vermilion, forked male at Christiania University, Norway, two females and four males having a light brownish eye color appeared. These were purified for this condition by inbreeding, and such females were then bred with males heterozygous for the character star and dichaete in order to determine the chromosome location of this new factor. The offspring from this mating were all red-eyed, and results indicated that the factor was linked with star and, therefore, located in the second chromosome. It was also de-

terminated that 30 per cent of crossing over had occurred between star and the factor for the brown eyes. By mating homozygous brown-eyed, black-bodied females with similar heterozygous males it was also shown that the locus for brown was in the second chromosome. By further experiments with factors for plexus venation and arc wings the locus for the brown-eyed condition was found to be at 102.1 in the second chromosome.

The independence of the seminal gland and secondary sexual characters in fish, R. COURRIER (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 1, pp. 70-72).—In stickleback fish during the summer the male is distinguished from the female by a red pigmentation and a mucous secretion from the renal cells which are not evidenced in the winter. These secondary sexual changes have been associated with the breeding season and the activity of the seminal glands, but it is here suggested that this activity is due to a difference in the nourishment, light, or temperature, since somewhat the same histological conditions are found in the sex organs during the winter. For this reason stickleback fish were kept in an aquarium at 17° C. and were plentifully supplied with food. It was found that the customary enlargement of the spermatie bulbs occurred without the usual pigmentation and mucous secretion. This indicates that the secondary sexual characters appear independent of the seminal gland and are due to other causes, possibly hormones.

The alterations of secondary sexual characters in a tubercular cock, B. D. MILOJEVIC (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 22, pp. 89-91).—A description of a cock is given which had much the appearance of a pullet except that the plumage about the neck showed a slight modification toward the male. The tail was as of a pullet and the crest and spurs were absent. At about six or seven months of age this bird died of generalized tuberculosis. Histological examinations of the testicle showed no clear abnormalities in the form or number of the interstitial cells, as might have been expected when the secondary sexual characters were so modified.

The characters of a hybrid resulting from the mating of a Canard Muscovy male duck and an Egyptian female goose, A. LÉCAILLON (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 1, pp. 68, 69).—A hybrid from this cross which occurred at the Toulouse zoological garden is described.

Report on commercial feeding stuffs, 1921, E. M. BAILEY ET AL. (*Connecticut State Sta. Bul.* 238 (1922), pp. 327-361).—The composition and retail price of the samples of cottonseed meal, linseed meal, wheat bran, wheat middlings, red dog flour, wheat mixed feed, rye feed, gluten feed, gluten meal, hominy feed, corn meal, brewers' dried grains, distillers' dried grains, dried beet pulp, and proprietary horse, dairy, stock, and poultry feeds collected by the feed inspector for analysis during 1921 are given, as in previous reports (E. S. R., 45, p. 375), as well as analyses of samples of hay, silage, alfalfa, alfalfa meal, wheat feed, red dog flour, gluten feed, sweet corn seed, cottonseed feed, ground oats, beet pulp, distillers' dried grains, and stock and poultry feeds submitted by individuals for analysis. Parts of the laws relating to feeding stuffs are included, as well as the definitions of the feeding stuffs as adopted by the Association of Feed Control Officials.

Analyses of commercial feeding stuffs and registrations for 1922, C. S. CATHCART (*New Jersey Stas. Bul.* 369 (1922), pp. 5-70).—This is the report of the microscopical and chemical analyses of the feeding stuffs inspected in New Jersey during 1921. The feeds analyzed include cottonseed meal, linseed meal, gluten feed, gluten meal, hominy feed, brewers' dried grains, distillers' dried grains, malt sprouts, dried malt grains, buckwheat feed, buckwheat middlings, buckwheat offal, corn-and-cob meal, corn and oats, corn bran, corn feed meal,

rye bran, rye feed, rye middlings, wheat bran, wheat feed, red dog flour, wheat middlings, wheat and rye middlings, alfalfa meal, dried beet pulp, coconut oil meal, oat groats, peanut oil meal, tankage, and fish scrap, as well as a large number of proprietary stock and poultry feeds.

Inspection of commercial feeds, P. H. WESSELS (*Rhode Island Sta. Ann. Feed Circ.*, 1922, pp. 3-16).—After giving a brief summary of experiments at several other stations in feeding cattle, swine, and poultry, as reported in recent bulletins and circulars, the guaranteed and found protein and fat content of the following feeding stuffs inspected are given as in previous reports (E. S. R., 45, p. 872): Cottonseed meal, gluten feed, gluten meal, linseed meal, hominy feed, wheat bran and screenings, wheat middlings, rye middlings, and various proprietary stock and poultry feeds.

The national center of zootechnic experimentation at Vaulx-de-Cernay, M. LAPLAUD (*Rev. Zootech. [Paris]*, No. 2, (1921), pp. 111-116).—This is a description of the establishment and lines of work of the experiment station at Vaulx-de-Cernay, France. The animals consist of 50 draft horses on feeding and draft experiments in a comparison with cattle and tractors; 210 cattle on feeding, breeding, crossing, and draft experiments; 4 breeds of sheep on improvement crossing, breeding, and lambing experiments; 5 breeds of hogs in experiments in studying precocity, quality of meat, and the improvement of breeds; and various breeds of poultry.

Experiments in fattening cattle in 1920 at Vaulx-de-Cernay, M. LAPLAUD (*Rev. Zootech. [Paris]*, No. 4 (1922), pp. 326-334, figs. 3).—Experiments in fattening cattle at Vaulx-de-Cernay on pasture during 1920 are reported. Three lots of cattle were included in the tests, composed respectively of 6 steers 8 to 10 years old, 10 2 to 3-year-old steers, and 4 2-year-old heifers. The length of time these animals were on test varied somewhat, but it averaged from May 26 to October 12. The general results showed that the heifers made an average daily gain per head of 1.26 kg., the young steers 1.16 kg., and the old steers 0.685 kg.

Cattle breeding in Limagne, FORET and E. LÉTARD (*Rev. Zootech. [Paris]*, No. 7 (1922), pp. 646-662, figs. 10).—This is a discussion of the cattle-breeding operations in Limagne, France. The cattle found are mostly Charollaise, Salers, and Ferrandaise, which have been crossed in many cases. Descriptions are given of the three breeds, as well as the crosses which have resulted between them.

The cattle of Morocco, A.-M. LEROY (*Rev. Zootech. [Paris]*, No. 6 (1922), pp. 512-525, figs. 7).—This is a discussion of cattle breeding in Morocco. A description of the breeds with their origin is given, together with measurements of the cattle of different ages and a discussion of their uses and milk production.

The exportation of French breeds to Brazil for the improvement of the native live stock, L. MISSON (*Rev. Zootech. [Paris]*, Nos. 3 (1921), pp. 210-219, figs. 7; 4 (1922), pp. 338-352, figs. 8).—The native breeds of cattle and horses in Brazil are described, and a discussion is given of the possibilities of improvement which should occur, as well as information on the specific breeds of animals which can help most in bringing about this improvement. The most attention is given to cattle, with some space to horses and a few suggestions for improving asses and sheep.

The value of the fifth quarter of beef, P. DECHAMBRE and E. DEGOIS (*Rev. Zootech. [Paris]*, No. 7 (1922), pp. 634-645).—This is a discussion of the edible parts of beef not included in any of the four quarters, the total of these parts being called the fifth quarter. From 82 head of cattle of various breeds, ages, and weights slaughtered at the Vaulx-de-Cernay Station, the percentages

of the live weight of the following substances are presented in tables: Tongue, brain, cheek, liver, heart, stomach and intestine, skin, and tallow. Suggestions are offered showing the effect of the fifth quarter on the value of the live animal.

Native feeds for fattening lambs, F. A. HAYS (*Wyoming Sta. Bul. 130* (1922), pp. 16, fig. 1).—Lamb fattening experiments with sunflower and oat-and-pea silage, carried on during 1919–20 and 1920–21, are reported in continuation of those previously noted (E. S. R., 45, p. 471). Each year 100 lambs were divided as evenly as possible into four lots and fed for 70 days.

In the 1920 experiments the purpose was to compare oat-and-pea silage with sunflower silage and cottonseed meal with linseed meal for fattening lambs. The rations consisted of $\frac{1}{4}$ lb. of cottonseed meal per lamb per day in lots 1, 2, and 3, and the same amount of linseed meal in lot 4, together with, in lot 1, 1 lb. of native hay and a full feed of oat-and-pea silage, in lot 2 1 lb. of native hay and the same amount of sunflower silage as oat-and-pea silage in lot 1, and in lots 3 and 4 a full feed of native hay.

In the second year's experiments all lots received daily about 0.75 lb. of cracked corn per head, as well as in lot 1 a full feed of alfalfa hay, lot 2 one-quarter feed of alfalfa hay and a full feed of oat-and-pea silage except for the first 7 days, when frosted sunflower silage was fed, lot 3 one-half feed alfalfa and a full feed of sunflower silage, and lot 4 one-half feed alfalfa hay and a full feed of oat-and-pea silage.

Previous to the first year's experiments, the lambs developed lip and leg disease, and were all fed in one lot from November 17 to January 27. In the case of the second experiment the lambs were divided into their respective lots and fed for a preliminary period of 21 days on rations as planned for the experiment, but which differed from the above rations as follows: One-half instead of $\frac{1}{4}$ lb. of cracked corn was fed per head daily and sunflower silage was fed in lots 2 and 4 instead of oat-and-pea silage. During this period the lambs in lot 2, receiving a full feed of sunflower silage and a quarter feed of alfalfa hay as roughages, did not do well and appeared to be getting an over-feed of sunflower silage.

The results of the 70-day feeding tests during the two years are reported in detail in the following table:

Summary of lamb-fattening experiments.

Ex- peri- ment.	Lot.	Average daily feed consumed per lamb.						Average initial weight.	Average daily gain.	Feed consumed per 100 lbs. gain.		
		Concentrates.		Hay.		Silage.				Concen- trate.	Hay.	Silage.
		Kind.	Amt.	Kind.	Amt.	Kind.	Amt.					
1	1	Cottonseed meal.	Lb. 0.46	Native.	Lbs. 0.96	Oat-and-pea.	Lbs. 2.35	Lbs. 71.65	Lb. 0.25	Lbs. 188.48	Lbs. 390.21	Lbs. 956.64
1	2	do.	.46	do.	.96	Sunflower...	2.35	71.61	.20	230.32	493.47	1,181.84
1	3	do.	.46	do.	1.79	.....	.....	71.87	.23	203.56	798.85	.....
1	4	Linseed meal.	.46	do.	1.79	.....	.....	73.00	.20	227.49	888.33	.....
2	1	Cracked corn.	.79	Alfalfa.	2.00	.....	.....	70.28	.30	260.41	658.30	.....
2	2	do.	.82	do.	.52	Oat-and-pea ¹	1.88	63.13	.25	334.15	211.18	780.81
2	3	do.	.79	do.	1.00	Sunflower...	1.19	66.08	.29	278.72	349.77	415.88
2	4	do.	.79	do.	1.00	Oat-and-pea.	1.19	67.36	.26	301.42	380.99	452.12

¹ Only 24 lambs, as 2 died and only 1 was added during the preliminary feeding period in frosted sunflower silage, which was also fed during the first 7 days of this test.

Analyses of the various feeds are reported.

Ovarian grafts in goats and ewes, É. RETTERER and S. VORONOFF (*Compt. Rend. Soc. Biol. [Paris]*, 84 (1921), No. 3, pp. 104-106).—The authors selected two goat experiments for this discussion in which ovarian tissue was implanted in the horns of the uterus after double ovariectomy. The grafts degenerated and were absorbed, but maternal placentas developed in the uterine mucosa at the sites of the grafts. It is concluded that the development of the decidua can not be attributed exclusively to corpora lutea.

Evolution of maternal placentas or caruncles after ovarian grafts, É. RETTERER and S. VORONOFF (*Compt. Rend. Soc. Biol. [Paris]*, 84 (1921), No. 4, pp. 187-189).—The authors describe in greater detail the changes in the uterus in the experiments noted above. There was first a hyperplasia of the surface of the mucosa leading to the formation of an epithelial syncytium. The deeper connective tissue was transformed in the "pulp cells," which persisted after the disappearance of the decidua and took part in the reconstruction of the mucosa.

Hog feeding experiments, J. I. THOMPSON and E. C. VOORHIES (*California Sta. Bul.* 342 (1922), pp. 373-396).—Two series of pig feeding experiments are reported which were carried on from 1914 to 1919. The first series consisted of four trials to determine the pork-producing value of alfalfa pasture when supplemented by full and limited feeds of concentrates consisting mostly of rolled barley which was soaked from one feed to the next when hand fed. The following table gives the more important data on these experiments:

Summary of pig feeding experiments showing the economy of pork production on alfalfa pasture with full and limited feeding of concentrates

Trial and lot.	Kind of pasture.	Supplemental feeds	Method of feeding.	Number of pigs	Length of test	Average initial weight.	Average daily gain.	Feed per 100 lbs. of gain		Dressing percentage
								Barlev.	Other feeds.	
					Days.	Lbs.	Lbs.	Lbs.	Lbs.	P. ct.
I-1	Alfalfa, $\frac{1}{2}$ acre	Rollod barley.....	Self-fed.	22	84	94.2	1.32	465	..	.....
I-2	..do..	Rollod barley and tankage ¹	..do..	22	84	91.6	1.40	437	27	.....
II-1	Dry lot....	Soaked rolled barley..	Hand-fed..	12	84	74.8	.70	526	..	68.2
II-2	Alfalfa, $\frac{1}{2}$ acre	..do.....	..do....	12	84	73.2	.79	376	..	74.2
II-3	..do....	Rollod barley..	Self-fed....	12	84	74.6	1.28	393	..	80.5
II-4	..do....	Rollod barley and tankage	..do....	12	84	73.8	1.39	381	28	82.9
II-5	Dry lot....	Soaked rolled barley and green cut alfalfa.	Hand-fed..	12	84	71.1	.72	386	495	67.1
II-6	Alfalfa, $\frac{1}{2}$ acre.	Soaked rolled barley and shorts, 2:1.	..do....	12	84	74.8	.74	252	125	76.2
II-7	..do....	Soaked rolled barley and coconut meal, 2:1.	..do....	12	84	71.3	.80	238	112	72.7
II-8	..do....	Soaked rolled barley and cull beans, 2:1.	..do....	12	84	75.7	.75	249	121	63.8
III-1	Dry lot....	Soaked rolled barley..	..do....	12	98	102.2	.93	599	.....	(2)
III-2	Alfalfa, $\frac{1}{2}$ acre.	..do.....	..do....	12	98	101.0	1.14	520	.....	79.8
III-3	..do....	Rollod barley..	Self-fed....	12	98	100.9	1.22	445	..	79.1
III-4	..do....	Rollod barley and tankage.	..do....	12	98	100.8	1.25	442	14	78.8
III-5	Dry lot....	Soaked rolled barley and cut alfalfa, green.	Hand-fed..	12	98	102.1	1.01	560	160	78.7
III-6	Alfalfa, $\frac{1}{2}$ acre.	Soaked rolled barley and wheat shorts, 2-3:1.	..do....	12	98	103.3	1.26	350	150	80.3

¹ Wheat shorts for the first 2 weeks.

² 77.7 per cent for 8 and 7.36 per cent for 1.

Summary of pig feeding experiments, etc.—Continued.

Trial and lot.	Kind of pasture.	Supplemental feeds.	Method of feeding.	Number of pigs.	Length of test.	Average initial weight.	Average daily gain.	Feed per 100 lbs. of gain.		Dressing percentage.
								Barley.	Other feeds.	
III-7	Alfalfa, $\frac{1}{2}$ acre.	Soaked rolled barley and coconut meal, 3-4:1.	Hand-fed.	12	Days 98	Lbs. 103.3	Lbs. 1.27	Lbs. 360	Lbs. 110	P. ct. 80.0
III-8	do.	Ground milo and tankage.	Self-fed.	12	98	102.8	1.51	.....	* 400	83.1
IV-1	do.	Rolled barley, 1 lb. daily to 100 lbs. live weight.	Hand-fed.	9	135	60.0	.34	230	.....	.....
IV-2	do.	Rolled barley, 2 lbs. daily to 100 lbs. live weight.	do.	10	135	61.0	.57	317	.....	.....
IV-3	do.	Rolled barley, 3 lbs. daily to 100 lbs. live weight.	do.	10	135	61.0	.83	382	.....	.....
IV-4	do.	Rolled barley.	Self-fed.	9	135	59.0	1.14	480	.....	.....
IV-5	do.	Rolled barley and coconut meal.	do.	9	135	60.0	1.21	450	13	.....

* And 1 lb. of tankage.

In the fourth trial where limited feeding on alfalfa pasture was practiced, the authors state that it was evident that lot 1 would have utilized twice as much pasture, lot 2 needed some more pasture, lot 3 fully but not overly utilized their pasture, and that lots 4 and 5 did not need but about half as much pasture. Alfalfa pasture was found to increase the gains of pigs about 0.14 lb. per day over pigs fattened in the dry lot, and 115 lbs. less barley were required to produce 100 lbs. of gain. Other conclusions not evidenced in the table were that pigs on self-feeders grow more evenly, the labor cost is less, and the finish is better.

The second series of experiments consisted of six feeding trials in the dry lot, using the feeds as shown in the table below. In trials IV, V, and V-a, the feeds were fed in a self-feeder and the milk supplements were fed three times a day. The raisins in trial VI were more effective as only half of the ration than when fed alone, as they caused scours. Fed as half the ration, 297 lbs. of raisins were found to equal 266 lbs. of barley. The following table gives the more important data taken from the dry-lot experiments:

Summary of the pig feeding trials in dry lot.

Trial and lot.	Ration fed.	Number of pigs.	Length of test.	Average initial weight.	Average daily gain.	Feed per 100 pounds gain.	
						Principal feed.	Supplement.
			Days.	Lbs.	Lbs.	Lbs.	Lbs.
I-1	Soaked rolled barley.	10	70	86.3	0.91	514	.....
I-2	Soaked rolled barley and whole alfalfa hay in rack.	10	70	87.5	.93	465	34
I-3	Rolled barley and cut alfalfa hay soaked together.	10	70	80.3	.88	463	67
I-4	Rolled barley and alfalfa meal soaked together.	10	70	87.5	.99	410	62
II-1	Whole milo heads and tankage.	10	137	83.2	.88	620	26
II-2	Threshed milo and tankage.	10	137	88.05	.81	593	31
II-3	Threshed ground milo and tankage.	10	137	90.7	.79	583	28
III-1	Whole milo heads and tankage.	8	100	95.5	.78	594	48
III-2	Ground milo heads and tankage.	8	100	95.6	.91	544	54
III-3	Soaked milo grain and tankage.	8	100	96.4	1.00	558	18
III-4	Ground milo grain and tankage.	8	100	95.8	1.00	536	25
III-5	Ground barley and tankage.	8	100	95.6	1.26	460	25
IV-1	Rolled barley and skim milk, 1:3.	6	138	62.3	1.18	352	1,073
IV-2	Rolled barley and whole milk whey, 1:5	6	138	61.2	1.16	368	1,230
IV-3	Ground milo and skim milk, 1:3.	8	80	73.1	1.55	289	596

Summary of the pig feeding trials in dry lot—Continued.

Trial and lot.	Ration fed.	Number of pigs.	Length of test	Average initial weight.	Average daily gain.	Feed per 100 pounds gain.	
						Principal feed.	Supplement.
			<i>Days.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
IV-4	Ground milk and whole milk whey, 1:5.....	8	80	72.9	1.32	349	1,346
V-1	Rollod barley, self-fed; skim milk.....	10	70	123.6	1.53	497	628
V-2	Rollod barley, self-fed; milkolene.....	10	70	123.1	1.30	579	735
V-3	Rollod barley and tankage, self-fed.....	10	70	123.4	1.50	506	11
V-4	Rollod barley and fish meal, self-fed.....	10	70	122.6	1.33	553	17
V-5	Rollod barley, self-fed.....	10	70	122.8	1.30	578	.....
V-a-1	Ground barley, self-fed, and skim milk.....	10	58	111.8	1.60	413	705
V-a-2	Ground barley, self-fed, and milkolene.....	10	58	112.8	1.17	575	705
V-a-3	Ground barley and tankage, self-fed.....	10	58	112.9	1.37	490	28
V-a-4	Ground barley and fish meal, self-fed.....	10	58	112.2	1.35	489	29
VI-1	Ground barley and alfalfa meal, 5:1.....	8	105	115.2	.94	563	161
VI-2	Ground barley, raisins, and alfalfa meal, 5:5:2.....	8	105	108.1	.89	297	164
VI-3	Raisins and alfalfa meal, 5:1.....	8	105	108.1	.39	1,113	127

¹ Alfalfa meal. In addition, 15 pounds of alfalfa hay were consumed per 100 pounds of gain in lots 1 and 2 and 19 pounds in lot 3.

² Each of barley and raisins.

Swine experimental work, E. H. HOSTETLER (*North Carolina Sta. Rpt. 1921, pp. 45, 46*).—Brief notes are given on the results of experiments being conducted.

Determinations of the bone and carcasses of two hogs weighing 226 and 176 lbs., respectively, showed that the bone composed about 8 per cent of the carcass weight. Hogs fed on rations composed largely of peanuts and peanut meal made good gains, but the carcasses were all soft or medium. Pork from hogs fed on peanuts was found to shrink slightly less than from corn and tankage (*E. S. R., 43, p. 465*). Curing meat in warm weather by pumping brine into it produced edible meat, whereas meat cured in brine spoiled. Soy bean pasture supplemented with a 2 per cent grain ration was found to produce good gains. The cost of raising pigs to weaning was found to be \$4.07 at the Edgcombe Test Farm and \$3.97 for Poland-Chinas at the Statesville Test Farm.

[Feeding experiments at the Washington Station with swine], H. HACKBORN (*Washington Col. Sta. Bul. 167 (1922), pp. 12-14*).—A continuation of the study of the comparative value of protein supplements for swine (*E. S. R., 45, p. 270*), with 74 pigs averaging at the start of the test 40 to 70 lbs. in weight, has shown that there is practically no difference in feeding value between fish meal containing 56 per cent protein and tankage containing 60 per cent protein when fed as a supplement to a basal ration of rolled barley and wheat shorts. Coconut meal, however, was found to be too bulky when fed with this ration. Comparative tests were carried on with these feeds in the dry lot, on pea forage, and on alfalfa forage.

One lot of 7 pigs averaging 83 lbs. in weight, turned on 2 acres of fairly ripe pea forage yielding 36.3 bu. per acre, for 60 days, made average daily gains of 1.53 lbs. Another similar lot of pigs placed on pea forage yielding 29.1 bu. per acre, with access to tankage self-fed, made average daily gains of 1.54 lbs. The tankage-fed pigs produced 323.5 lbs. of pork per acre, with a grain requirement of 529.7 lbs. of peas and 25.5 lbs. of tankage per 100 lbs. of gain. The pigs on pea forage alone produced 321.2 lbs. of pork per acre, with a feed requirement of 678.5 lbs. of peas per 100 lbs. of gain. It is calculated that the tankage cut down the amount of peas required for 100 lbs. of gain sufficiently to justify its use.

The Gascon breed of swine, J. GIRARD (*Rev. Zootech. [Paris]*, No. 3 (1921), pp. 260-268, figs. 4).—This gives a history and description of this breed, which is stated to be a vigorous, rustling hog which is very prolific, and has a high dressing percentage of meat of excellent quality.

Measure of the cutaneous surface of the horse, B. ROUSSY (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 3, pp. 195, 196, fig. 1).—The author shows the application of the formula $S = Pm \times Hpm$ for measuring the area of the cutaneous surface of the horse. In this formula S equals area, Pm refers to the average circumference of the head, body, and legs of the horse as determined by measurements around 15 different parts of the head, body, and fore and hind legs, and Hpm refers to the length of an imaginary line through the center of the circumferences which were measured. The areas of the ears, tail, and plantar surfaces of the feet are calculated separately and added. The author compared the calculated area of an artificial horse with that obtained by adding together the areas of the squares, triangles, etc., as diagrammed on the body, and found close agreement between the two.

[Cottonseed meal for work horses and mules], E. H. HOSTETLER (*North Carolina Sta. Rpt. 1921*, pp. 46, 47).—Cottonseed meal in the ration of work horses and mules was found to cheapen the ration \$2.93 per year without affecting the health of the animals.

Poultry feeding, J. E. DOUGHERTY (*California Sta. Circ. 242* (1922), pp. 22, fig. 1).—This circular gives instructions for feeding laying and breeding hens, chicks, and fattening birds. A table compiling the composition and digestibility of a large number of poultry feeds is included.

Calcium in eggshell formation, G. D. BUCKNER, J. H. MARTIN, W. C. PIERCE, and A. M. PETER (*Jour. Biol. Chem.*, 51 (1922), No. 1, pp. 51-54).—This is the report of an experiment carried on at the Kentucky Experiment Station to study the utilization of calcium from different sources in the formation of bone and eggshells in poultry. Six lots each consisting of ten 7-months-old White Leghorn pullets were fed from December 1, 1920, to August 1, 1921, without access to the ground, on a ration composed of grain and tankage, with free access to minerals from the following sources: Lot 1, no mineral material; lot 2, granite grit; lot 3, granite grit and oyster shells, lot 4 granite grit and limestone, lot 5, limestone; and lot 6, rock phosphate.

At the start of the test, two birds similar to those used in the experiments were killed and the femurs and tibias weighed and analyzed for CO₂-free ash and CaO contained therein. During the test, records were kept of the number of eggs laid by each bird, and analyses of the three first eggs laid by each bird during each month were made. At the end of the 8 months' feeding period the femurs and tibias of each bird were analyzed, as well as the femurs and tibias of the control birds on free range during the 8 months, but receiving the same feed as lot 3. The results indicate that the CO₂-free ash of the leg bones and the eggshells from lots 1 and 2 was less than that from the other lots, except in the case of lot 6, where the ash from the eggshells was about the same as lots 1 and 2. It thus seems that the calcium from the calcium carbonate can be utilized for the production of both bone and eggshells, whereas the calcium and tricalcium phosphate can be utilized for the growth of bone but not for the production of eggshells.

The functions of grit in the gizzard of the chicken, G. D. BUCKNER and J. H. MARTIN (*Poultry Sci.*, 1 (1922), No. 4, pp. 108-113).—In carrying on the experiments reported above, studies were made of the grit content of the gizzards of birds in the different lots and in the controls at the time they were killed. The following amounts of grit were found: Two controls killed December 1, 1920, 18.4 gm.; lot 1, 12.6; lot 2, 14.2; lot 3, 9.7; lot 4, 12.1; lot 5, 4.3;

lot 6, 5.4; and the control killed August 1, 1921, 23 gm. The grit consumed during the eight months was for lot 2, 9.9 lbs.; lot 3, 6.1, and lot 4, 3.1 lbs. The fowls in lot 2 probably ate an extra amount of grit in an attempt to supply the calcium which was lacking in the ration.

[Experiments with poultry], B. F. KAUPP ET AL. (*North Carolina Sta. Rpt. 1921, pp. 43, 44*).—In a number of experiments with poultry, 7.2 lbs. of feed was required to produce 1 doz. eggs. A pound increase in fattening chickens cost from 8 to 23 cts. Gains of 28.3 to 29 per cent in weight were made by cramming. Rations containing 14 and 22.5 per cent of velvet beans were injurious to the health of the birds, and 20 per cent peanut meal in the ration produced gains of 22 per cent at a feed cost of 14 cts. per pound. Artificial lighting increased yearly egg production 42.2 per cent (E. S. R., 45, p. 71). Straw lofts had no effect on egg production. Animal proteins could not be replaced by vegetable proteins, and in tests lasting one week substantially equal gains followed the use of digested tankage, blood meal, soy bean meal and dried milk, and meat scrap. Turning eggs five times a day increased the hatchability 20 per cent over eggs turned once a day. Spraying eggs increased the hatchability of fertile eggs from 54.3 to 64.5 per cent, respectively. Rhode Island Reds on dry lot laid 33 eggs per year, whereas others on range laid 71 eggs per year. With meat scrap in the mash there was an increased production, ranging from 61.1 eggs on dry lot to 69.9 eggs for the birds on range.

Metabolism and respiratory exchange of poultry during vitamin starvation (*New York State Sta. Rpt. 1921, pp. 24, 25*).—When normal hens, during the period of maximum egg production, were fed polished rice, the first effect on the birds during the vitamin starvation was a loss of appetite. This was followed by a continuous loss in weight and cessation of egg production, with active symptoms of polyneuritis in from six to eight weeks. See also a previous note by Anderson and Kulp (E. S. R., 47, p. —).

Breeding Rhode Island Reds for standard type and egg production, H. A. BITTENBENDER (*Iowa Sta. Bul. 202 (1922), pp. 9-24, figs. 21*).—A study of the trap-nest and breeding records kept since 1908 and the results of selection against standard disqualifications and breeding defects practiced on the station flock of Rhode Island Reds has led to the conclusion that the selection of breeders for egg production should be confined to those birds of standard type with ample constitutional vigor. A clean cut head, with alert and prominent eyes and no tendency toward meatiness or puffiness were the important characteristics of the high producing hens, as well as amply body capacity. Early molters were also to be discarded. Broodiness was found to be more readily broken up when birds were removed from the nests immediately. Studies of the color indicated that matings should be made between males and females of the same shade of red color free from excess black or white.

Moulting, MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul., 10 (1922), No. 2, pp. 33-35*).—A popular discussion of moulting with its relation to egg production is given.

Culling farm poultry, L. F. PAYNE (*Kansas Sta. Circ. 93 (1922), pp. 34, figs. 23*).—This circular gives general directions for culling hens. The author states that culling should be practiced monthly from July to October. The important considerations when culling are present production, persistence of production, and rate of production. Directions are given for making the above determinations and for selecting breeding males. A glossary of culling terms is also included.

The value of the sexograph as an indicator of the sex of poultry eggs, R. LIENHART (*Compt. Rend. Soc. Biol. [Paris], 84 (1921), No. 17, pp. 884-886*).—The author cites an experiment with a sexograph, consisting of a copper ball

and chain, with which he determined the sex of 150 eggs and hatched them in two lots according to the sex indicated. The hatching results showed practically the same proportion of males and females in both lots, indicating the inaccuracy of the sexograph.

Directions for the tanning and dressing of furs, J. Dixon (*California Sta. Circ. 237 (1922), pp. 5, figs. 3*).—Directions for removing and tanning furs are given.

DAIRY FARMING—DAIRYING.

An economic study of dairying on 149 farms in Broome County, N. Y., E. G. MISNER (*New York Cornell Sta. Bul. 409 (1922), pp. 273-443, figs. 23*).—This is an exhaustive study of the economic factors entering into the cost and returns from 149 dairy herds in Broome County, N. Y., for the year ended May 1, 1915. The data for this study were taken by the survey method during July and August, 1915, except in case of the milk sold and the butter-fat tests of the milk, which were obtained from the records of the milk plants where the milk was purchased. The farms selected were variously distributed in Broome County, the only specification being that they should have 6 or more cows, the average per farm in this study being 13.8. The results of the work are presented in 5 parts, dealing with the cost and returns from the whole dairy enterprise as a unit, from the cows alone, from raising heifers, from herd bulls, and from veals and bulls to be sold. These data are summarized in the following table for each group:

Summary of costs and returns from 149 dairy herds and from the cows, heifers, herd bulls, and bulls to be sold.

Source of costs and returns.	Entire herd.		Cows.		Heifers		Value for herd bulls.	Value for veals and bulls to be sold.
	Amount	Value.	Amount	Value.	Amount	Value.		
COSTS.								
Concentrates..... tons	1,611	\$48,219	1,448	\$42,858	134	\$4,390	\$948	\$23
Succulent feeds..... do.	5,194	24,609	4,777	22,512	335	1,700	397	..
Skim milk and buttermilk..... tons.	22	77			67	238	17	13
Whole milk..... do.					108	3,518	429	3,127
Dry forage..... do	5,277	50,790	4,283	40,722	806	8,146	1,011	11
Pasture..... acres	7,928	11,591		9,338		1,907	346	..
Bedding..... do.		2,080		1,673		292	115	..
Human labor..... hours	381,101	54,768	345,370	49,408	27,734	4,160	1,200	.....
Horse labor..... do.	12,575	1,886	11,279	1,692	1,259	189	6	.....
Hauling milk..... do.		19,685		19,685				.....
Use of buildings..... do.		11,315		5,706		2,143	464	2
Use of equipment..... do.		1,308		1,015		221	72	.....
Interest on value of stock..... do.		8,155		6,657		1,181	317	.....
Interest on value of feed and supplies..... do.		1,908		1,512		306	91	.....
Miscellaneous costs..... do.		3,890		11,189		182	20	15
Total costs.....		240,288		216,967		28,573	6,333	3,191
RETURNS.								
Milk products sold..... pounds.	* 1,215	343	* 1,215	343				
Milk sold..... tons.	5,237	171,552	5,237	171,552				
Milk and milk products used on the farm..... pounds.	* 370,242	* 7,309	* 911,149	* 14,574				
Appreciation on cattle..... do.		27,988		19,897		21,887	3,339	3,876
Manure recovered..... tons.	20,642	25,802	15,917	19,897	3,870	4,838	1,063	5
Miscellaneous returns..... do.		351		* 4,817			142	.....
Total returns.....		233,345		211,183		26,725	4,544	3,881

* Includes \$5,722 depreciation on cows and \$1,788 for cost of keeping herd bulls not included in miscellaneous costs of entire herd.

* Equivalent in whole milk.

* and * Difference equals amount fed to cattle.

* Includes returns from calves and hides of \$4,608.

Data for this table are based on 2,058 cows, 1,002 heifers, 172 herd bulls, 377 veals, and 76 bulls to be sold, except in the case of the pasture costs which included results of 2,018 cows, 607 heifers, and 106 herd bulls. The costs of purchased feeds were calculated at market prices, and the cost of hauling was included in labor, equipment, etc. Home-grown feeds were charged at their market value. On these farms, however, 96 per cent of the grain fed was purchased. Nearly all of the succulent feed consisted of corn silage, all of which was home grown. In the table, it will be noted considerable skim milk, buttermilk, and whole milk were charged to the young stock, but only 21.8 tons of skim milk was charged to the entire herd, since only this amount was purchased, the rest coming from the cows.

The dry forage consisted mainly of mixed and timothy hay, the remainder consisting largely of corn stover, oat-and-pea hay, and clover hay. Pasture was charged at cost, allowing 5 per cent interest on the valuation, 0.5 per cent for taxes, and the expenses of fencing, reseeding, etc. An average of 3.1 acres were pastured per animal unit for a period of 159 days. Three-fourths of the bedding consisted of oat straw, most of which was home grown. The remainder consisted largely of purchased sawdust. Man labor was charged at 15 cts. per hour, woman and child labor at 10 cts., and horse labor at 15 cts. per hour. Hired milk hauling was charged at cost. Otherwise milk hauling was charged according to the labor required.

The charges for interest on money invested in feed, stock, etc., and use of buildings are based at the rate of 5 per cent and any expenses or change in valuation which have occurred during the year. The returns from the dairies were from milk and milk products sold or used on the farm, either in the house or for feeding young stock, appreciation in the value of the herd, value of manure recovered, and miscellaneous returns such as boarding cattle, breeding fees, and hauling neighbors' milk. The milk products were valued at the price received for that which was sold. The manure was valued at \$1.25 per ton.

Based on the results of the entire herds, it was found to require for 100 lbs. of milk produced 28.3 lbs. of grain, 91.6 lbs. of succulent feed, 92.7 lbs. of dry forage, 3.7 hours of human labor, 0.62 hour of horse labor, and the investment of \$4.42 in capital at a total calculated cost of \$1.704. Based on the results from the cows only, these amounts were slightly less in all cases.

Studies were made showing the effect on cost and returns of the size of the herd, season of milk production, feeding, production per cow, butter-fat test of milk, location of the farm, cow-testing associations, and methods of hauling milk. As a result of the above studies, it was concluded that the cost of production was lowest and the gains largest in the large high-producing herds making a large proportion of their milk in summer. The herds producing milk with a low butter-fat test were more profitable, and greater returns seemed to come from the valley dairies.

It was found to cost \$56.84 per cattle unit to raise heifers, a cattle unit consisting of two heifers. Of this cost 28.5 per cent was for dry forage, 15.4 for grain, 14.6 for human labor, and 12.3 per cent for whole milk. Deducting the value of manure, etc., the net cost of raising a heifer to 2 years of age was \$52.06.

The relations of the cost of raising heifers and keeping herd bulls to the size of the herd, season of milk production, and the milk production of the cows are discussed. Costs and returns on veals and bulls to be sold are also presented in detail. In discussing the losses which are evidenced in the table from each group except the bulls sold, the author states that the producers either accept lower wages than they are credited with, or accept less than farm value for the roughage used, or accept a lower rate of interest on their invest-

ments, or a combination of the above. Otherwise they could not stay in the business.

Relation of production to income from dairy cows, J. C. McDOWELL (*U. S. Dept. Agr. Bul. 1069 (1922), pp. 20, figs. 11*).—The author summarizes data obtained from 96 cow-testing associations, totaling 120 sets of yearly records obtained from 1910 to 1920, inclusive, which indicate that the income from milk and butter fat above the cost of feed increases rapidly with the higher producing cows even though the cost of feed also increases. With cows producing 396 lbs. of butter fat per year, the returns per dollar expended for feed were \$1.52 as compared with \$0.35 for cows producing 109 lbs. The data are tabulated both on the basis of milk production and fat production according to the form in which the product was sold.

It is concluded that "cows having high average production of milk and butter fat averaged high in income above feed cost regardless of breed, age, weight, date of freshening, and geographical location."

Influence of season of freshening on production and income from dairy cows, J. C. McDOWELL (*U. S. Dept. Agr. Bul. 1071 (1922), pp. 10, figs. 2*).—In tabulating data as to the influence of the season of freshening on the production and income from dairy cattle, records from 64 cow-testing associations, including 10,870 cows, indicated that the cows freshening in the fall (September, October, and November) ranked highest in yearly production of milk and butter fat, in cost of feeds, and in income over feed costs. Cows freshening in the winter came second in all cases.

Tables showing the ranking of the cows freshening in the different seasons and months in each association are given according to yearly milk and butter fat production, average price of milk, cost of grain, roughage, and total feed, and income above feed costs. From the results, the author concludes that while the records seem to indicate that fall and early winter freshening are desirable in most of the country, dairymen will usually find it advantageous to produce a steady amount of milk from month to month. It is also stated that the results from special localities may differ.

[Experiments with dairy cattle at the North Carolina Station], S. COMBS (*North Carolina Sta. Rpt. 1921, pp. 48-50*).—Velvet bean meal was found to lack palatability when fed to 12 cows with cottonseed meal.

In a test to determine the effect of cottonseed meal upon growth and reproduction, the Ayrshire herd was divided into five lots of 4 cows each except lot 1 which consisted of 8 cows. The cows in lot 1 received a ration of cottonseed meal and cottonseed hulls. Five of these cows aborted, the calves being blind in four cases. Two of the cows developed cases of dropsy and had fits, one of them dying and the other proving sterile, and one cow calved twins which were allowed to nurse the dam for six weeks, when one was blind and the other getting blind. The latter calf was transferred to a nurse cow, retained its sight, and at six months of age was 200 lbs. heavier than the other calf. Similar results were obtained in the other lots fed different rations containing cottonseed meal and cottonseed hulls. Normal results, however, were obtained with lot 5 which was a check lot. Feeding the milk of the cows on heavy cottonseed meal rations to calves did not produce good growth even when large amounts of the milk were fed.

The odor and flavor in onion flavored milk has been found to be produced by allyl sulphid, which may be precipitated with mercuric chlorid or platinum chlorid. Heating the milk to 140 or 150° F. and pumping air through it is giving encouraging results in removing the onion flavor from milk.

Sunflower silage for milk production, S. I. BECHDEL (*Pennsylvania Sta. Bul. 172 (1922), pp. 3-16*).—Feeding trials with sunflower silage, previously mentioned (*E. S. R., 47, p. 478*), are reported in more detail.

Two groups of 7 dairy cows each were fed for two feeding periods of 6 weeks on a grain mixture of equal parts of wheat bran, cottonseed meal, linseed meal, corn-and-cob meal, and ground oats, and mixed hay consisting of one-third clover and two-thirds timothy, with corn silage during one feeding period and sunflower silage during the other feeding period. One lb. of grain was fed for each 3 to 4 lbs. of milk produced, with hay at the rate of 0.8 lb. and silage at the rate of about 3.25 lbs. per 100 lbs. live weight. Analyses of the grain, hay, and silage used are reported.

The first week's results of each feeding period were not calculated in the averages for the experiments, since this was a transition period. A repetition of these experiments was carried on in a second trial except that the silage composed of one-half corn and one-half sunflowers was compared with corn silage, and there were 6 cows in each group instead of 7. The following table gives the averages of the 5 weeks' test periods for each group:

Summary of feeding experiments with corn and sunflower silage.

Ex- per- iment	Group	Kind of silage.	Weeks	Feed consumed			Average gain in live weight.	Production	
				Grain	Hay	Silage		Milk	Fat
				Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	1	Corn.....	2-6	1,411.2	2,023.0	7,711.7	3	4,823.7	217.03
1	1	Sunflower.....	8-12	1,206.8	2,023.0	8,009.0	-7	3,689.9	176.82
1	2	do.....	2-6	1,379.2	2,065.0	7,970.0	-10	4,405.5	203.29
1	2	Corn.....	8-12	1,234.8	2,065.0	8,120.0	-25	4,508.7	192.64
2	1	Sunflower and corn	2-6	1,335.6	1,643.0	7,859.3	20	4,197.3	182.17
2	1	Corn.....	8-12	1,275.4	1,728.7	7,967.3	44	4,129.4	179.10
2	2	do.....	2-6	1,365.0	1,698.7	7,759.0	20	5,014.5	215.60
2	2	Sunflower and corn.	8-12	1,311.9	1,758.6	7,925.9	24	4,286.7	185.70

The lower production which occurred with the sunflower or sunflower and corn silage was attributed mainly to the fact that sunflower silage was not as palatable as corn silage.

A study of calf rations, E. G. WOODWARD (*Washington Col. Sta. Bul.*, 167 (1922), pp. 21, 22).—In these studies 8 calves fed whole milk to 2 weeks of age and gradually changed to condensed buttermilk from the second to the third week, after which only the buttermilk was fed with alfalfa hay and a grain mixture, made average daily gains of from 1.3 to 1.6 lbs. until from 4 to 6 months of age. The amount of buttermilk varied from 1.25 lbs. at first to 4 lbs. per day at 3 months of age. These calves were not subject to scouring as often occurs with skim milk.

Three Jersey calves similarly fed on skim milk powder for 80 days made average daily gains of about 1 lb. From 1 to 2 lbs. of skim milk diluted with 9 lbs. of water was fed per day.

Judging dairy bulls, H. E. McNATT (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 2, pp. 42-46, figs. 6).—This is a brief popular description of the qualities to be desired in a dairy bull, with diagrams showing good and poor bulls.

The Kerry herds of Ireland (*Waterford: Kerry Cattle Soc. Ireland, 1920, pp. 36, figs. 17*).—A history and description of Kerry cattle are given, as well as a list and brief descriptions of the herds of Kerry cattle in Ireland, the rules and by-laws of the Kerry Cattle Society of Ireland, milk records, etc.

Dairying in Florida, W. A. McRAE ET AL. (*Fla. Dept. Agr. Quart. Bul.*, 32 (1922), No. 2, pp. 1-170, figs. 16).—Several articles on dairying and live stock farming are reported, most of which describe or refer especially to Florida conditions.

Thirty-ninth annual report of the Dairymen's Association and of the Dairy School of the Province of Quebec, 1920 (*Dairymen's Assoc. Prov.*

Quebec Ann. Rpt., 39 (1920), pp. 133, figs. 3).—This is the usual annual report of the Dairymen's Association and Dairy School of the Province of Quebec, including the papers presented at the convention of the society at Ste. Scholas-tique on December 1 and 2, 1920.

The degree of acidity of milk, I. M. KOLTHOFF (*Handel. Genootsch. Melkk.*, 1920, pt. 2, pp. 5-16).—The results of 24 tests on the acidity of milk made with methylene blue and phenolphthalein, using different amounts in the tests and different dilutions of the milk, showed a marked but gradual decrease in the amounts of NaOH required to produce the neutral point with the use of more indicator or a greater dilution of the milk.

Variations in some characteristics of the fat of buffalo and cow milk with changes in season and feeding, F. J. PLYMEN and A. R. P. AIYER (*India Dept. Agr. Mem., Chem. Ser.*, 6 (1921), No. 4, pp. 187-208).—The authors report in tabular form a series of determinations of the physical and chemical characteristics of butter fat and ghee from milk produced by individual cows and buffaloes and by mixed herds of cows and buffaloes in India during the course of complete lactation periods. The characteristics of the butter fat were determined by saponification, iodine, Wijs, Reichert-Meissl, Polenske, Kirschner, and Ave Lallemand tests and the melting point. A great deal of variation was observed in these values in the butter fat from individual animals and from herds during different parts of the year. The greatest variation from standard figures, however, seemed to occur during the hot dry months. By the determinations made it was impossible to differentiate between the butter fat produced by cows and buffaloes. According to the usually accepted standards of some of the tests much of the butter fat produced by milch cows in India would be regarded as adulterated.

The mutual applicability of the analytical figures for butter fat and ghee, F. J. PLYMEN and A. R. P. AIYER (*India Dept. Agr. Mem., Chem. Ser.*, 6 (1921), No. 5, pp. 209-214).—This work consists of a comparison of the analyses of the fat of ghee and butter made from cream unripened, naturally ripened, ripened with buttermilk starter, and ripened with an artificial starter. The same tests were used as reported above, as well as the butyro-refractive index at 40° C. In the butter and ghee made, very uniform values were obtained in the different tests, indicating that the methods of ripening cream and preparing butter at a low temperature or ghee at a high temperature (155°), do not have any significant effect on the analyses of the fat for purity.

Discussion of milk hygiene in the Dutch East Indies, J. A. LENSCHOEK (*Handel. Genootsch. Melkk.*, 1920, [pt. 1], pp. 18, fig. 1).—This gives a description of the conditions of milk production in the Dutch East Indies, dealing with the small amounts of fresh milk used and the difficulties encountered in milk production.

Effect of steaming upon the germ life in milk cans, H. A. HARDING, M. J. PRUCHA, H. M. WEETER, and W. H. CHAMBERS (*Jour. Dairy Sci.*, 5 (1922), No. 3, pp. 282-290).—Tests at the Illinois Experiment Station in steaming milk cans showed that it is not practical to obtain sterile milk cans by steaming alone, since three minutes constant steaming under 25 lbs. pressure did not make them entirely free from bacteria. It was determined that when the volume of steam blown into a can amounted to 5 cu. ft. the average bacterial count of the can was such that it would have increased the bacterial count of milk in it less than 1,000 per cubic centimeter. Nine cu. ft. of steam would decrease the bacteria so that less than 100 would be added per cubic centimeter, and 11 cu. ft. of steam would reduce the bacteria so that less than 10 per cubic centimeter would be added to the milk. The impracticability of using the latter amounts of steam was brought out.

A note on the choice of culture media for the study of lactobacillus, with special reference to the carbohydrates employed, L. F. RETTGER and W. L. KULP (*Abstr. in Abstr. Bact.*, 6 (1922), No. 1, p. 24).—Due to the difficulties in making large amounts of whey media for growing *Lactobacillus acidophilus*, studies were reported before the Society of American Bacteriologists on the merits of a number of carbohydrate media for growing these organisms. Media containing from 0.5 to 1 per cent of galactose have been found to be a good substitute. Maltose also gave good results, but dextrose seems to be unsatisfactory.

The cultivation of certain of the lactobacilli, J. M. SHERMAN and W. R. ALBUS (*Abstr. in Abstr. Bact.*, 6 (1922), No. 1, p. 17).—A medium composed of 1 per cent of a fermentable carbohydrate, 1 per cent peptone, 1 per cent dried yeast, 1 per cent butter fat, and 0.1 per cent agar, and having a pH value of 6.5 to 7 was stated in a paper presented before the Society of American Bacteriologists to be satisfactory for growing all types of lactobacilli, many of which could not be maintained for successive generations on any of the ordinary media.

Preliminary report on the flora of Cheddar cheese, G. J. HUCKER (*Abstr. in Abstr. Bact.*, 6 (1922), No. 1, p. 16).—In a paper presented before the Society of American Bacteriologists, the results of bacterial studies of 37 samples of Cheddar cheese purchased on the market were given. In this cheese 265 cultures were found, which ranked in the following classes in the order of frequency of occurrence: Spore formers, Gram-negative rods, lactobacilli, *Streptococcus lactus*, coeli, and streptococci. The better qualities of cheese yielded cultures belonging to the lactobacillus and coeli groups.

How to standardize the ice cream mix, R. M. WASHBURN (*Creamery and Milk Plant Mo.*, 11 (1922), No. 1, pp. 62, 64, 65).—A table is presented showing the composition of the different substances used in preparing an ice cream mix and thus enabling easier calculation of the amounts of the ingredients necessary to make a mix of a definite composition. The fact is also mentioned that a product is on the market which contains all the ingredients of the mix in a powdered form, it being only necessary in using this to dissolve it in water and allow it to stand a sufficient time before freezing.

A new era in packaging ice cream, T. MOJONNIER (*Creamery and Milk Plant Mo.*, 11 (1922), No. 1, pp. 70, 72, 73, 60).—The author gives a description of the method of making brick ice cream by a machine which runs the ice cream directly from the freezer into the cartons before hardening. Much labor and handling is thus saved.

Proper depreciation for ice cream equipment, L. W. ROSZELL (*Creamery and Milk Plant Mo.*, 11 (1922), No. 4, p. 84).—Depreciation of buildings, refrigerating and ice machinery, tubs, cans, and delivery equipment is discussed in relation to the ice cream business.

VETERINARY MEDICINE.

Pathological biology (the science of immunity), H. MUCH (*Die Pathologische Biologie (Immunitätswissenschaft)*). Leipzig: Curt Kabitzsch, 1920, 3. ed., rev., pp. 323, pls. 6, figs. 7).—This volume consists of three introductory chapters on immunity in general, followed by chapters on poisons, diseases caused by the action of toxins, anaphylaxis, biological diagnosis, chemotherapy, and special diseases.

Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1920–21, D. A. D. AITCHISON (*Madras Civ. Vet. Dept. Ann. Admin. Rpt. 1920–21*, pp. 20).—This annual report includes accounts of the occurrence of and work with contagious diseases of live stock and the administration report of the Madras Veterinary College. Considerable statistical data are presented.

Annual report for the year 1920-21, W. LITTLEWOOD ET AL., (*Egypt Min. Agr. Vet. Serv. Ann. Rpt., 1920-21, pp. V+73*).—This usual annual report (E. S. R., 46, p. 773) includes details of the occurrence of the diseases of live stock during the year, and of the work of the veterinary pathological laboratory, the School of Veterinary Medicine, and the Serum Institute.

Studies on cultural requirements of bacteria, I, II, J. H. MUELLER (*Jour. Bact.*, 7 (1922), No. 3, pp. 309-338).—The first of the two papers presented outlines the plan of work and describes the methods followed by the author in his studies upon the problem of the nutritional requirements of certain bacteria. The original plan of the work was to study the growth of pneumococci and hemolytic streptococci on meat infusion broth and then on broth from which certain factors had been removed, various amino acids, purin bases, etc., being substituted to determine the nature of the material removed from the media. The standard medium consisted of ordinary meat infusion peptone broth containing 0.1 per cent of glucose and brought to an H-ion concentration of 7.4 to 7.8. In all the experimental media in which the ordinary meat infusion was not used, the salt mixture used in Uschnsky's and other similar media was substituted for common salt. Growth of the organism was determined after 24 hours by a turbidity test with standards of suspended barium sulphate.

The preliminary work reported furnishes evidence that in addition to carbohydrates two classes of organic compounds are required for the growth of pneumococci and streptococci, the first supplied by protein degradation products and the second by meat extractives. Both occur in ordinary meat infusion, but they may be separated more or less completely by repeated extraction of the meat, alcoholic precipitation of meat infusion, and charcoal decolorization of heart infusion.

The second paper describes attempts at the separation of the activating material from beef heart infusion.

Short boiling of the infusion with 2 per cent Norit removed some component of the meat infusion and rendered it unsuitable for the growth of the streptococcus. The inactive infusion thus formed may be reactivated by the addition of small quantities of peptone or acid hydrolysate of certain proteins such as casein and edestin, but not by the acid hydrolysates of such proteins as wool, silk, and wheat gluten. The activating material may be precipitated from hydrolysates of casein by precipitation with mercuric sulphate. This active material may be separated by precipitation with silver sulphate and barium hydroxide into two fractions active only when combined. The silver sulphate precipitate, or X fraction, is readily destroyed by phosphotungstic acid. The silver sulphate filtrate, or Y fraction, contains a considerable quantity of a new sulphur-containing amino acid.

Serum sickness in cattle and horses, F. GERLACH (*Ztschr. Immunitätsf. u. Expt. Ther.*, 1, Orig., 34 (1922), No. 1-2, pp. 75-94, figs. 6).—Evidence is given that the vaccination of cattle against anthrax with immune horse serum is often accompanied by evidences of anaphylaxis. Anaphylactic symptoms are also produced in horses by the injection of human and guinea pig serum, but not by normal swine serum. Bovine serum does not cause as marked a reaction in horses as horse serum in cattle. These observations are thought to indicate the necessity of the use of homologous serum if serum sickness is to be avoided.

The comparative pathogenicity of several strains of *Bacterium abortus* (Bang), I. F. HUDDLESON (*Michigan Sta. Tech. Bul.* 55 (1922), pp. 3-14).—The author's studies here reported, mainly in tabular form, show "that a large number of strains of *B. abortus*, after several generations of cultivation on an artificial medium, lose the property of producing lesions in

the organs of guinea pigs on inoculation. A majority of the strains isolated became nonvirulent within one year after isolation. The cultural findings agreed with the presence or absence of lesions, that is, when characteristic lesions were found in the organs of the guinea pig *B. abortus* was also present; *B. abortus* was not found in the absence of lesions. The agglutination and complement fixation antibody indices of the blood sera were low in pigs showing no lesions and high in pigs showing lesions. There was a marked decrease in weight of the majority of the pigs showing lesions and an increase in weight in those showing no lesions.

"The results of this study indicate that there are in existence a large number of nonvirulent strains of *B. abortus*. Before one undertakes experiments to induce abortion in cattle, swine, sheep, etc., or to determine the efficacy of various prophylactic agents such as antisera, vaccines, and chemicals, it is fundamental that the virulence of the strain of *B. abortus* employed should be determined by such means as guinea-pig inoculations."

On the knowledge of the causative agent of foot-and-mouth disease, H. STAUFFACHER (*Ztschr. Wiss. Zool.*, 118 (1921), No. 4, pp. 511-636, pls. 2, figs. 46).—This is an account prepared by the author in March, 1917.

The struggle against, and extermination of, foot-and-mouth disease, L. HOFFMANN (*Die Bekämpfung und Ausrottung der Maul- und Klauenseuche*. Hannover: M. & H. Schaper, 1921, pp. VIII+316, figs. 29).—This monograph, while essentially an attempt to prove the superiority of the author's system of treatment of foot-and-mouth disease with the disinfectant eugoform (E. S. R., 33, p. 580; 35, p. 280), contains considerable information on the course of foot-and-mouth disease in Germany, and various attempts at its control.

Concerning cutaneous habronemiasis or summer sore, FAYET (*Bul. Soc. Cent. Méd. Vét.*, 98 (1922), No. 4, pp. 94-98).—A discussion of recent observations on this parasitic affection.

The lesions in necrobacillosis, S. A. GOLDBERG (*Cornell Vet.*, 12 (1922), No. 3, pp. 272-275, pl. 1).—In discussing this affection, the author calls attention to the fact that it is the cause of foot rot of sheep and cattle, necrotic dermatitis of various animals, necrotic quittor, lip and leg ulceration of sheep, necrotic stomatitis, diphtheroid of calves, necrotic gastritis, enteritis, anovulvitis, and vaginitis.

Can bloodsucking insects transmit rinderpest? G. CURASSON (*Rev. Gén. Méd. Vét.*, 31 (1922), No. 362, pp. 57-60, fig. 1).—A limited number of experiments indicate that the proboscis of bloodsucking tabanids retains a small amount of the blood, which may be sufficient to convey the infection if its passage from the affected to the healthy animal is not long delayed and if the number of tabanids is large. This infection, however, does not take place if the intervals between the two engorgements is 15 minutes or more. The passage of the virulent blood through the digestive tube of the tabanid insures its sterilization.

Colocynth tar (Ar. Zeit el Handal), its medical uses, with particular reference to the cure of scabies, F. E. MASON (*Agr. Jour. Egypt*, 10 (1920), pp. 48-53).—The author finds that colocynth tar does not irritate the skin, and that the proper application of three dressings at intervals of five days cures all ordinary cases of sarcoptic mange in camels and in equines. Psoroptic mange in equines is cured by one dressing. Its application destroys ticks, it is a valuable dressing for surface wounds and abrasions, sore back, "sit fast," and wounds about the feet and legs, and it also prevents attacks from flies.

Experimental studies of a strain of the avian tubercle bacillus of porcine origin, L. T. GILTNER (*Cornell Vet.*, 12 (1922), No. 3, pp. 224-239).—"An avian type of the tubercle bacillus was isolated from slight caseocalcareous lesions localized in the cervical glands of a pig, and was found to agree in morphologi-

cal and cultural characters with a true avian type recovered from a white-fronted tree duck.

"It was found that the change in the H-ion concentration of two lots of glycerin broth, one sown with the pig bacillus and the other with the bird strain, when examined at intervals of about a week during a period of about eight weeks, was the same in each case. There occurred a gradual change of pH from the neutral range toward the alkaline range. There was a decrease in the H-ion concentration.

"The pig strain did not possess so high a degree of virulence for guinea pigs and rabbits as the bird strain. After a single passage of the pig bacillus through a fowl it manifested nearly as great virulence for that animal as did the bird strain. Subcutaneous inoculation of two pigs and two calves with the pig strain of the avian bacillus failed to produce definite lesions of tuberculosis in those animals. One of the two pigs reacted to the intradermal avian tuberculin test but did not react to the subcutaneous injection of human tuberculin. The other pig reacted to intradermally injected avian tuberculin but not to human tuberculin. The animal failed to react to the subcutaneous injection of avian tuberculin. The two calves reacted to avian tuberculin injected both intradermally and subcutaneously, but not to human tuberculin. A hen infected with the pig organism reacted to avian tuberculin. Another hen infected with the same bacillus reacted on the first test to human tuberculin, on a second test to avian tuberculin, and on a third test to a tuberculin prepared from the pig organism. A repetition of the three tests in the same order resulted in only a moderate reaction to the avian tuberculin."

A list is given of 25 references to the literature cited.

The nature and systematic position of *Bacillus paratyphosus* C. F. W. ANDREWEES and S. NEAVE (*Brit. Jour. Expt. Path.*, 2 (1921), No. 4, pp. 157-174, figs. 6).—"A new form of paratyphoid fever has been observed during the war by many investigators, chiefly in eastern Europe and in Asia. The causal organism, *B. paratyphosus* C is distinct from *B. paratyphosus* A and B, though presenting relationship to the latter.

"In this paper there is described a case of paratyphoid C occurring in England. The bacillus isolated is compared with other members of the *Salmonella* group in detail. In its cultural and fermentative character *B. paratyphosus* C is shown to differ from *B. paratyphosus* B in its failure to ferment inositol and in its slower rate of alkali production. It differs from *B. suispestifer* in fermenting arabinose and dulcitol.

"A short review is given of the serological properties of *B. suispestifer* and of the related forms *B. veldgassen* and *B. glässer*. We find the *suispestifer* to fall into two serological groups, sharply separable by certain sera. By absorption tests it is shown that a Group I *suispestifer* will exhaust the sera of both Groups I and II, but that a Group II *suispestifer* will exhaust only Group II sera, leaving the specific titer of Group I sera untouched. *B. paratyphosus* C is shown to belong serologically to the Group I *suispestifer*s, in spite of the divergence in cultural characters.

"Different strains of *B. paratyphosus* C vary in their relation to *B. paratyphosus* B. In some the B element is absent, in others very obvious. An example of each variety was isolated from the case described, and it is shown that the strain which at first showed no relation to *B. paratyphosus* B gradually underwent a serological change, acquiring the property of being partially agglutinated by a paratyphoid B serum."

Lungworms of domestic animals. M. C. HALL (*Cornell Vet.*, 12 (1922), No. 2, pp. 131-157, figs. 9).—This is a summary of the status of knowledge of the lungworms of domestic animals, which was presented as an address at the annual conference for veterinarians, held at Ithaca, N. Y., in January, 1922.

The author concludes that at the present time nursing is the only treatment that promises good results in lungworm infestation. A bibliography of 20 titles is included.

The control of sheep scab by treatment with sulphur-dioxid gas, KRETZSCHMAR (*Deut. Landw. Tierzucht*, 24 (1920), No. 40, pp. 411, 412, figs. 4).—In experiments conducted at Munich, where hundreds of sheep suffering from scabies were treated with sulphur-dioxid fumes, excellent results were obtained. The sheep were inclosed, four in a box, their heads only emerging through openings, with india-rubber collars to prevent the fumes from escaping. Exposure for 50 minutes to 4 per cent sulphur-dioxid fumes was found to be sufficient for shorn sheep, but 4.5 per cent was required if unshorn. An account by Pfenninger of sulphuration for mange in mules has been noted (*E. S. R.*, 43, p. 184). Illustrations are given of the boxes in which the application is made.

Oxidation of polysulphid during use of sheep dip, F. L. MELVILL (*Jour. So. African Chem. Inst.*, 5 (1922), No. 1, pp. 9-16).—The author finds that the greatest loss of active sulphur on mixing the lime sulphur dip (1-25) is 4 per cent, while the greatest loss after dipping 100 sheep in 250 gal. of wash only amounts to 10 per cent of the active sulphur originally present. These figures are considered surprisingly low in view of the fact that the volume of wash after dipping was not much over 120 gal. and the temperature in one case had risen to 74° F., or 14° above the initial temperature, thus favoring oxidation. The effectiveness of this dip depends upon the content of polysulphid sulphur.

The etiology of polyarthritis in swine, A. R. WARD (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 2, pp. 155-161).—This article is based upon observations of autopsy material and animal inoculation experiments conducted in the pathological division of the U. S. D. A. Bureau of Animal Industry. The investigations are summarized and conclusions drawn by the author as follows:

"*Bacterium pyogenes* has been isolated from one case of multiple arthritis in the pig. The pathological condition of the case in question differed from others in the series studied in that periarticular abscesses were present. Pigs inoculated intravenously with *B. pyogenes* twice developed suppurative lesions in the bones. Those of the legs were usually located at the point of junction of the epiphysis with the shaft. The synovial cavities of adjoining joints exhibited suppurative conditions and were connected with the bone lesions by fistulae. Introduction of cultures of *B. pyogenes* directly into the cavity of the femoro-tibial articulation of rabbits usually induces arthritis promptly.

"In a large percentage of the joints examined there was found a small Gram-positive rod-shaped organism identified as *B. erysipelatis-suis*, otherwise known as *B. rhusiopathiae*. Positive cultural results were obtained most frequently in cases exhibiting distention of the synovial capsule by serous fluid containing masses or flakes of exudate. Other conditions observed were lesions of the articular cartilages, the presence of numerous large synovial villi, together with extensive proliferation of connective tissue and bone. The viscid exudate often was slightly colored by the presence of blood cells. Among other cells present, lymphocytes were most numerous. Polymorphonuclear leucocytes were present in only small numbers. Microscopic examination of synovial exudate revealed but few of the rod-shaped organisms, if any. In joints exhibiting more advanced lesions, such as excessive exostosis with ankylosis, the synovial fluid was normal in appearance and generally sterile.

"Arthritis has been produced in a pig by intravenous injection with *B. erysipelatis-suis*, and the same organism was isolated from the lesion at autopsy. The femoro-tibial articulation of a rabbit was infected with the organism in question by direct introduction of culture into the joint cavity. One intra-

venous inoculation of the rabbit with the organism induced infection of the stifle joint characterized by the presence of an excessive amount of grayish exudate. A pure culture was recovered. It is believed that *B. erysipelatis-suis* bears an etiological relation to arthritis in the pig.

"As all the observations herein recorded are based on material from abattoirs (leg only), no conclusions can be drawn regarding possible mortality associated with the form of swine erysipelas causing arthritis. It is desirable that field observations be made with reference to the possibility of the occurrence of outbreaks of swine erysipelas associated with heavy mortality."

Other investigations relating to this subject by the author have been noted (E. S. R., 36, p. 280; 37, p. 276; 38, p. 585).

A new parasite of the pig, *J. E. ACKERT* and *F. K. PAYNE* (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 2, pp. 186-188).—During the course of investigations of the relation of the domestic pig to the spread of human hookworm disease in Trinidad, British West Indies, the authors discovered in the native pigs a nematode resembling the human hookworm (*Necator americanus*), which they describe as *N. suillus* n. sp. While the human hookworm generally occurs in the duodenum, the pig *Necator* is most commonly found in the ileum and jejunum. The bloody ulcers caused by these hookworms and the emaciated appearance of the host pigs containing many worms indicates that *N. suillus* is of economic importance in Trinidad. Post-mortem examinations of pigs from various parts of the island showed that both old and young pigs were infested, some containing several hundred of these hookworms.

Preliminary note on a new species of *Gongylonema* from American swine, *E. A. CHAPIN* (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 1, p. 68).—The author finds that the species of *Gongylonema* occurring in swine in the United States differs from the species occurring in swine in Europe, and describes it under the name *G. ransomi* n. sp.

A contribution to the biology of the causative agent of equine infectious anemia, *HABERSANG* (*Monatsh. Prakt. Tierheilk.*, 32 (1921), No. 1-2, pp. 1-18, figs. 7; abs. in *Cornell Vet.*, 11 (1921), No. 4, pp. 282-284).—A progressive anemia and the character of the fever are two symptoms complex which characterize this affection.

It is pointed out by the author that the following characteristics suggest that infectious anemia is malarial-like or protozoan in nature. "Hematological findings and progressive decrease in the red blood cells, the distinctly typical swelling of the spleen (deposit of pigment), the absence of changes in the white blood cells, the peculiar character of the epidemic, and the clinical course (chronic and latent forms, virus carriers)." The irregularities in the fever curves described are explained on the theory that the horse is affected with several generations of anemia virus, and that each generation, as in malaria, develops to febrile-producing stages.

On the knowledge of the rôle of bloodsucking insects in the transmission of equine infectious anemia, *L. PANISSET* (*Rev. Gen. Méd. Vét.*, 31 (1922), No. 364, pp. 191-197).—This is a brief discussion of recent work on the subject, including that of J. W. Scott (E. S. R., 42, p. 678) and others.

Joint or navel ill (*pyosepticemia pullorum neonatorum*), its origin, treatment, and prevention, *J. G. VÆTH* (*Die Fohlenlähme (Pyosepticæmia Pullorum Neonatorum) ihre Entstehung, Behandlung, und Verhütung. Hannover; M. & H. Schaper, 1921, pp. 99*).—This revision of a work, first issued as an inaugural dissertation more than 10 years previous, deals with the history of the affection, its occurrence, etiology, portal of entry, effect, pathological anatomy, diagnosis, treatment of foals, and prophylaxis.

A contribution to the study of joint-ill in animals, *J. P. M'GOWAN* (*Scott. Jour. Agr.*, 5 (1922), No. 1, pp. 59-73).—The author presents an account of the

disease as it occurs in foals and follows by a discussion of his experiences with it in sheep. The information obtained led him to conclude that in the outbreaks observed navel infection was not responsible for its occurrence. He concludes that, owing to the lowered resistance of the lamb, a gastrointestinal disturbance was set up whereby organisms, normal inhabitants of the intestinal tract of the sheep, were enabled to invade the tissues and thus produce the disease.

On the parasite of nodular peribronchitis of the horse, C. PÉREZ and J. DESCAZEUX (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 27, pp. 411-413, fig. 1).—Nodular peribronchitis of the horse is said to be a seasonal affection, occurring in July and August and characterized by the appearance in the superficial pulmonary parenchyma of nodules varying in size from that of a hazelnut to a walnut, in the center of which is a bronchiole. The parasitic origin of the lesions was first recorded by Liénaux in 1902 and later by Césari and Alleaux in 1908. The authors' studies have led them to conclude that it is caused by the larva of *Habronema megastoma*.

Observations and theories on the causes of chick mortality, A. B. WICKWARE (*Canad. Vet. Rec.*, 3 (1922), No. 1, pp. 4-8).—This is a paper prepared with the view of calling attention to the factors which predispose chicks to disease and which as prime causes, independent of diseases, lead to the death of many young chicks. A table showing the effects of various rations on the mortality and growth of young chicks is included.

A preliminary note on parasites infesting domesticated silver black foxes in Canada, J. A. ALLEN and A. B. WICKWARE (*Parasitology*, 14 (1922), No. 1, pp. 27, 28).—The authors present a list of the animal parasites of silver foxes that they have met with.

The efficiency of carbon tetrachlorid against hookworms in the silver black fox, J. A. ALLEN (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 1, pp. 31-37, fig. 1).—Attention is first called to the importance of *Uncinaria stenocephala* on Canadian fox farms as a parasite of the fox, 24 per cent of 1,422 individuals examined having been found infested. In some ranches the percentage of infestation was found to be as high as 65, and only comparatively few ranches were absolutely free from infestation. The experiments with carbon tetrachlorid as an anthelmintic, here reported, have been summarized by the author as follows:

"When given to foxes at the rate of 0.3 cc. per kilogram of body weight (5 minims for each 2.2 lbs.), carbon tetrachlorid showed an efficiency of 93 per cent against hookworms. Only one death occurred among the experimental animals. This death was attributed to the poor condition of the animal. When foxes are overcome by carbon tetrachlorid as a result of the capsule being broken while being forced into the pharynx, a number of these animals can be revived by artificial respiration. Only 7 died out of a total of 399 foxes treated with 20 minims of carbon tetrachlorid. Carbon tetrachlorid is more efficient and much less dangerous than either chloroform or thymol. The indications are that carbon tetrachlorid is also efficient when used against ascarids in the silver black fox."

Braxy in hares, J. P. M'GOWAN (*Scot. Jour. Agr.*, 4 (1921), No. 2, pp. 164-172).—The author concludes that while there is every justification for designating the disease of sheep generally known as braxy (*E. S. R.*, 34, p. 383) by that name, the name should not be used for the disease of hares, which really consists of two diseases, namely, coccidiosis and hemorrhagic septicemia.

RURAL ENGINEERING.

Surface water supply of the Lower Mississippi River Basin, 1918 (*U. S. Geol. Survey, Water-Supply Paper* 477 (1922), pp. 38, pla. 2).—This report, prepared in cooperation with the States of Colorado and Kansas, presents the

results of measurements of flow made on streams in the Arkansas and Red River Basins during the year ended September 30, 1918.

Rating curves for canal head gates, J. HINDS (*Reclam. Rec. [U. S.], 13 (1922), No. 5, pp. 98, 99, figs. 3*).—A brief mathematical analysis of the flow of water through orifices is given, together with curves showing the theoretical and actual values of the coefficient of discharge, corresponding to the net drop in feet, and a set of rating curves for a 3 by 2 ft. outlet, showing discharges in cubic feet per second for different net drops and heights of opening.

Copper sulphate treatment for preventing algae growths in lakes and reservoirs, N. L. HUFF (*Engin. and Contract., 58 (1922), No. 2, pp. 33-36, figs. 3*).—Lake and reservoir studies conducted at the University of Minnesota on the use of copper sulphate for preventing the growth of algae in lakes and reservoirs are reported.

It was found that copper sulphate may be used successfully for this purpose in amounts which are not injurious to fish or animal life. However, the quantity of copper sulphate required to eliminate algal growth depends upon the kind of organism causing the trouble, and the temperature, the organic matter and carbon dioxide content, and the hardness of the water.

The importance of intelligent and constant supervision of such work by one who understands the organisms in the water is emphasized.

Aggregate strength no measure of concrete strength, F. E. GIESFCKE (*Engin. News-Rec., 88 (1922), No. 26, pp. 1090, 1091, figs. 2*).—Studies conducted at the University of Texas on the subject, which included 28-day and 3-months tests, are reported.

The course aggregates studied covered practically the entire range from the hardest to the softest aggregates available in Texas for concrete construction. The series consisted of 300 test specimens, including 6 different aggregates and 5 different proportions of cement for each aggregate.

It was found that, for the materials tested and for the proportions of cement ordinarily employed in practice, the strength of concrete varied only slightly with the strength of its coarse aggregate. For very rich mixes and high ages the strength increased slightly with the strength of the coarse aggregate, but for ordinary mixes and an age of 28 days the strength of concrete made with comparatively weak limestone aggregate was as high as, or higher than, that of similar concrete made with the strong igneous rock aggregates.

Alkali attack on concrete roads and building brick, I. FURLONG (*Engin. News-Rec., 89 (1922), No. 2, pp. 64-67, figs. 7*).—In a contribution from the U. S. Bureau of Standards, the results of a study on the disintegration of concrete roads and building brick in the rice-field country of Glenn County, Calif., are presented.

It was found that where seepage into depressions has been the heaviest the alkali deposits are the most abundant, and the degree of highway concrete disintegration is a function of the amount of alkali in contact. In laboratory experiments with test specimens containing aggregates identical with those employed in the building of the Glenn County highway, the deleterious effects of the alkali were reproduced on such aggregates. In the range studied, the leaner mixes, when subjected to alternate wetting and drying in alkali water, yielded to the attack of alkali more rapidly and completely than the richer mixes. Under no conditions of experimentation with unprotected concrete was entire immunity to alkali water established.

The principal alkali found throughout the district is sodium sulphate, though in some places the concentration of magnesium sulphate reaches proportions worth considering. Whatever harm attributed to alkali that has been done to the highway or brick buildings in the affected region is considered to be due to a large extent to the water-soluble sulphates.

In a study of the disintegration of brick in the region, it was attempted to determine the relation of quality of brick to susceptibility to alkali attack. The bricks used were manufactured from a local raw material consisting of a natural mixture of about 1 part clay and 3 parts of sand. The alkali content of the average material from the so-called clay beds was about 1 per cent, with sodium sulphate predominating. The outstanding difference and conspicuously new phase found in the brick but not in the parent clay was water-soluble silica. This is attributed, however, to a reaction during the burning of the brick resulting from the fusion of alkali with water-insoluble silica. A field study of bricks in the affected area which were apparently immune to disintegration in any form showed that they had been more thoroughly burned than the disintegrated brick, resulting in a sealed condition with reference to percolating waters. These results are taken to indicate that porous brick disintegrate under alkali attacks much faster than dense nonporous brick.

Results of heavy traffic on Pittsburg test road (*Engin. News-Rec.*, 88 (1922), No. 26, pp. 1066-1069, figs. 4).—The results obtained from the test road at Pittsburg, Calif., up to January 28, 1922, are reported. Owing to failures of 4 of the 13 sections the tests were temporarily suspended to permit replacements.

Studies of the subgrades of the failing sections showed that thorough rolling of the sprinkled adobe subgrade, layer by layer, compacted it to such an extent that, after being flooded for three months, horizontal percolation was less than 1 ft. and vertical percolation less than 2 ft. The edges and corners of the concrete slabs, particularly at construction joints and transverse cracks where there may be some deflection under load, were found to be the weaker portions and ordinarily were the first to fail under heavy loads or adverse subgrade conditions.

It is concluded that because of the excessive deflection and corresponding destructive effect caused by impact a greater percentage of the time and money spent on pavements should be devoted to obtaining a perfectly smooth surface, particularly at construction joints.

A truck moving over a pavement was found to produce wave motion tending to lift the slab just in front of the deflection caused by the front wheels. A 6-in. slab after deflecting under a loaded 5-ton truck did not recover its former position for more than 2 hours. After long continued traffic this rate of return was somewhat slower, due probably to fatigue of materials.

Concrete surfaces were found to carry about 3,500,000 tons of traffic on solid rubber tires without abrasion.

Distribution of wheel load on pavement sections, H. F. CLEMMER and C. A. HOGENTOGLER (*Engin. and Contract.*, 58 (1922), No. 1, pp. 5-9, figs. 5).—The partial results of studies, conducted by the Illinois Division of Highways in co-operation with the U. S. Department of Agriculture, to determine the deflections of various road surfaces and corresponding pressures delivered to the subgrade during the passage of heavy motor truck wheels are reported. The behavior of corners adjacent to joints were also observed. Types of pavement studied were monolithic and semimonolithic brick, concrete, and bituminous filled brick on macadam base.

It was found that after initial pressure was applied the soil had a more or less definite bearing value, slightly greater than 1 lb. per square inch for 0.01 in. deformation. The supporting value of the soil was apparently less in March than in either August or October. The support under a rigid surface was extremely variable, indications being that the surface rests on small mounds of the subgrade, having little or no support in other areas. The condition of least support was found under the corners of sections. This support was improved by traffic action.

The distance through which the influence of the load was felt on an 8-in. macadam base was much less than that on an 8-in. concrete, while the corresponding pressure on the former was about five times as great as on the latter, indicating that a soil of much higher supporting value is required for a pavement on an 8-in. rolled stone base than is required for an 8-in. rigid type of pavement. The pressure exerted on the subgrade could be reduced by increasing the thickness of the rolled stone base.

The effect of temperature change was very noticeable in rigid pavements, causing both warping and longitudinal expansion and contraction. The effect of this temperature change was least in two joints, one between two monolithic sections and one between a monolithic and concrete section.

The deflection of an independent corner was about 13 times, and that of a confined corner about 63 times, that found at the center of the slab, indicating that the corner is the part of the slab which most deserves investigation. Neither the pressures nor the deflections as observed at corners varied directly with the magnitude of the load. Considerable movement can occur between the edges of adjacent slabs when there is not perfect contact between them, this movement being the cause possibly of shattering the edge or feathering about the joint. This movement is slightly increased by traffic. If perfect contact can be secured between adjacent edges of slabs, all movements between them will be eliminated, the deflections will be lessened and the effect of warping between night and day will be considerably reduced.

These results are taken to indicate that every effort should be made to devise means by which sections of pavement can be so tied together that movement between them will be eliminated, or in the absence of connection between sections at joints special designs should be used for increasing the resistance of the corners.

How to prolong the life of oils and engines, W. B. JONES (*Power Farming*, 31 (1922), No. 7, pp. 7, 8, 13, 14, figs. 2).—This is a comprehensive discussion of the ways in which wear occurs in an engine, how lubrication prevents it, and the requirements of effective lubrication.

The conclusion is drawn that long engine life and freedom from repair expense depend upon (1) maintaining continuously a film of oil between the working parts, (2) employing oil of such a grade and keeping it sufficiently free from dilution that the working pressure can not break through the film and cause metal to metal contact, and (3) keeping the oil film free from solid particles of such size and character as to bridge the thickness of the oil film and cause a cutting action on the bearing surfaces.

A system for continuous reclamation of engine oil is briefly described.

[**Recording dynamometer for tractors**], G. W. WATSON (*Engineering* [London], 113 (1922), No. 2948, pp. 814-816, figs. 10).—A recording dynamometer for tractors, which has been used in English tractor trials, is described and diagrammatically illustrated. This dynamometer is said to give a continuous graphic record of the drawbar pull, the speed, and the depth of plowing.

Equipping an orchard spray machine for use in alfalfa fields, C. WAKELAND (*Idaho Agr. Col. Ext. Circ.* 25 (1922), pp. 4, figs. 4).—Brief practical information is given regarding the equipment of an orchard spraying machine in order that it may be used for the spraying of alfalfa. A practical spray strainer is also described and diagrammatically illustrated.

Use and care of manila rope, F. A. JENKS (*Engin. World*, 20 (1922), No. 5, pp. 304-306, figs. 3).—Practical information on the use and care of manila rope, particularly of the larger sizes for heavy work, is presented.

Progress in dust-explosion prevention, D. J. PRICE (*Chem. and Metall. Engin.*, 26 (1922), No. 26, pp. 1203-1206).—In a contribution from the U. S. Department of Agriculture a summary is given of the losses resulting from

dust explosions in flour mills, grain elevators, cereal and feed mills, and other dusty industries during the past 45 years.

It is stated that a total of 242 dust explosions in industrial plants in the United States and foreign countries has been reported to the Department. In 52 of these explosions 379 lives were lost, and in 69 of them 651 persons were injured. The total money loss in 110 explosions from which figures are available was approximately \$3,000,000.

Preventive measures are briefly discussed.

Colloids and sewage disposal, F. W. MOHLMAN and L. PLABST (*Engng. World*, 20 (1922), No. 5, pp. 301-303).—A summary of existing knowledge on the relation of colloid chemistry to tank treatment of sewage is presented, and methods of study and determination of colloids and the results of processes for their removal are discussed.

It is concluded that there is a need for (1) a standard definition of the limits of size of colloids in sewage; (2) a standard method for the determination of sewage colloids; (3) a study of the effect of the H-ion concentration on the removal of colloids, correlated with other determinations and observations which will prove the validity of such pH determination; (4) tests of the practical application of precipitants which have been found effective in laboratory experiments, and (5) investigation of the principle governing the retention of moisture by sewage sludge.

It is stated that as yet in the removal of colloids by tank treatment but little has been accomplished in a practical way by settling alone or by the use of coagulants. Chemical precipitation by alkaline precipitants removes some of the colloidal matter, but adds so much to the bulk of the sludge that the use of the process is restricted.

The use of acids yields a well clarified effluent in many cases without the large bulk of sludge, but has not proved applicable except under special conditions. Activated sludge is said to be effective in removing colloids, but can not be classed under tank treatment.

Hydraulics of dosing tanks and trickling filters, E. E. SANDS (*Engng. News-Rec.*, 89 (1922), No. 2, pp. 67-69, figs. 3).—Mathematical and mechanical analyses of the subject are presented, the purpose being to show how to design dosing tanks and trickling filters so that settled sewage will be delivered intermittently at uniform rates per square foot.

Farm sewage disposal devices, H. W. RILEY (*Agr. Engng.*, 3 (1922), No. 6, pp. 99, 100, figs. 9).—This paper, a contribution from Cornell University, presents very briefly the features of design of farm sewage disposal devices which have been found by experiments to be essential. The numerical constants to be used for ordinary rural conditions in New York are also given, with diagrammatical illustrations.

RURAL ECONOMICS AND SOCIOLOGY.

Rural economics, E. JOUZIER (*Économie Rurale*. Paris: J. B. Baillière & Sons, 1920, 3. ed., rev. and enl., pp. 550, figs. 14).—This treatise offers a comprehensive discussion of the three phases of agricultural production, capital, land, and labor, also of farm organization, agricultural insurance, and the sale of the products of the farm.

Farm costs and relative profitableness of seven crops, Twin Falls County, Idaho, 1919 and 1920, B. HUNTER and S. B. NUCKOLS (*Idaho Sta. Research Bul.* 2 (1922), pp. 24).—This bulletin sets forth the cost of producing alsike clover seed, red clover seed, alfalfa hay, sugar beets, potatoes, beans, and wheat during the seasons of 1919 and 1920. Tabulated data are presented showing the acres seeded and harvested, average yields per acre, average land values per acre, and average labor, material, and operating costs, as well as

variations in net cost, the relation of yield to cost, basic requirements in labor and materials per acre, and average net profits and losses. A very wide range in the cost of producing each of the seven crops is exhibited, also a direct relation between yield per acre and cost per unit of each crop. Producing high yields is pointed out as one of the means of increasing farm efficiency and lowering cost of production.

Studies on cost of wheat production and grain farm organization in the Palouse, G. SEVERANCE (*Washington Col. Sta. Bul. 167 (1922), pp. 31-33*).—A preliminary study in cooperation with the U. S. Department of Agriculture and the University of Idaho, including 229 records gathered in the summer of 1920, indicated the following basic acre requirements for producing wheat:

Basic acre requirements for producing wheat.

Conditions of growth.	Man labor.	Horse labor	Seed.	Twine.	Part of total cost from direct labor.
	<i>Hours</i>	<i>Hours.</i>	<i>Bushels</i>	<i>Pounds.</i>	<i>Per cent.</i>
Winter wheat on fallow.....	8.0	33.7	1.4	2.9	21.3
Winter wheat on pea ground.....	8.4	22.1	1.4	3.5	21.4
Winter wheat after other crops.....	6.0	22.9	1.3	21.0	26.8
Spring wheat.....	7.0	29.8	1.3	2.0	27.1

The cost of milk production and dairy farm organization, G. SEVERANCE (*Washington Col. Sta. Bul. 167 (1922), pp. 30-31*).—According to records obtained from 91 dairy farms in four counties in the fall of 1920, the production of 100 lbs. of milk required 18.78 lbs. of grain, 43.13 lbs. of hay, 49.5 lbs. of silage, 5.6 lbs. of roots or kale, 0.003 month pasture, and 2.19 hours of man labor. "If local prices are applied to these quantities and the sum multiplied by 1.378, it is believed that the result will approximate the average cost of production."

Interdistrict farm competition, H. A. MULLETT (*Jour. Dept. Agr. Victoria, 19 (1921), No. 7, pp. 385-426, figs. 32*).—Records of the farm organization and business activities of 11 farms selected as winners in local district competitions in 1920 were obtained and examined in April and May, 1921, to determine the winner of the Royal Agricultural Society's competition in Victoria.

The area of the farms varied from 513 to 3,000 acres. The majority were wheat farms, ranging from 640 to 1,500 acres. The smaller the farm the greater the tendency toward heavy wheat production; on the larger farms relatively greater attention was paid to sheep.

Buildings, equipment, cropping systems, live stock, farm layout, water storage, fodder reserves, and farm homes are described.

The survey disclosed that for the years 1917-18 to 1919-20, inclusive, the competitors earned 5 per cent on the capital invested and additional sums ranging from £285 to £1,069. Wheat yields on the farms in the competition averaged 8 or 9 bu. larger than the averages for the districts.

The elements of agricultural bookkeeping, J. P. FACIO (*Bol. Min. Agr. [Argentina], 26 (1921), No. 3, pp. 265-319*).—Methods are set forth and illustrated with examples. Forms for entering the inventory and keeping accounts for agricultural, live stock, and dairy enterprises are given.

Economic problems of farm power, F. W. PECK (*Soc. Prom. Agr. Sci. Proc., 40-41 (1919-1920), pp. 27-38, figs. 2*).—Four main groups of factors to be considered in a study of the selection and utilization of forms of farm power are designated as (1) farm power requirements, (2) animal or mechanical power, (3) relation to man labor, and (4) influence on the organization and operation of the farm. Charts are given illustrating the utilization of horse

labor on three farms representing different types of production, a Wisconsin dairy farm, an Illinois corn and hog farm, and an Iowa seed grain and stock farm, the data being found in the results of cost accounting studies, and a table is included which shows the percentage of horse time spent on various operations on six typical farms. The intention is to bring out the important contributions that would result from a comprehensive study of each of these economic phases of the problem.

Annual report of the director of lands, C. LUKBAN (*Philippine Bur. Lands, Ann. Rpt. Dir. Lands, 1920, pp. 170, pls. 2, figs. 11*).—A progress report is made on cadastral and miscellaneous surveys of land in the Philippines for the fiscal year ended December 31, 1920.

The movement of Canadian wheat, R. J. McFALL (*Northwest. Miller, 130 (1922), No. 11, pp. 1156, 1168-1170, figs. 3*).—To reach the freight cars, Canadian wheat must pass through country elevators or over loading platforms. The Government has provided large elevators for storage at important centers within the country, mainly in the prairie, which serve as a temporary stopping place for the grain which is moved during the rush season. Their use, it is said, duplicates handling expense, increased storage at the farms or at the country elevators being needed to better equalize the movement.

The rail movement of Canadian wheat is practically confined to two principal transcontinental systems. Considerable seasonal pressure is brought to bear upon them, there being two principal peak loads of rail traffic into and out of the elevators in the East and one of movement into the western terminals. There are three possible rail routes for shipment of wheat eastward through Canada, as well as the water route of the Great Lakes, which is open from April to December. The bulk of this lake traffic goes from the Canadian twin ports, but some finds its way through Duluth and Superior. Similarly, the bulk of the rail traffic goes through the same cities, but some goes from Winnipeg and Quebec. From the terminal elevators at Fort William and Port Arthur the grain is mostly forwarded either to the American ports or to the so-called public elevators in the East.

A chart accompanies this article, which shows the movement of the Canadian wheat crop of 1919-20. A western and an eastern pool, with the principal streams into and out of them for the grain year, and also the movement through the chief grain centers of the country, are graphically presented.

It is brought out that Buffalo practically disappeared from the Canadian grain highway in the years immediately following the war, and that the Great Lakes-St. Lawrence water route has taken on decreased importance for unbroken shipments.

Statistics for recent years show the growing importance of the Georgian Bay route. Almost two-thirds of the lake movement in the year 1918-19, and one-half in the year 1919-20, was confined to the shorter route. In the later years the movement of grain by rail through eastern Canada into the United States for export has become a pronounced feature. The years 1918-19 and 1919-20, however, show a marked falling off in the transit trade through the United States, owing to several transient factors, the effects of which may or may not permanently disappear.

The outlook for dairying and the marketing of dairy produce, J. A. RUDDICK (*Canada Dept. Agr. Pamphlet 3, n. ser. (1922), pp. 20*).—In the first of these two papers the dairying countries of the world are discussed briefly, statistics being given to indicate whether production was restricted or stimulated by the war and the conditions which followed and still prevail to some extent. Recommendations are made with regard to improvement in the production and marketing of dairy products in Canada. In the second paper

some of the leading features of the system of marketing dairy produce in countries that compete with Canada in the world market are set forth.

A critical survey of the agriculture and live stock industry of Ecuador, J. PAVOLO (*Ecuador Dir. Gen. Agr. Bol. 1 (1921), pp. 52*).—A series of essays on agricultural conditions in Ecuador, labor problems, the lack of technical direction, and means of communication, with suggestions for encouraging immigration and increasing the supply of labor and capital, are published here.

The present condition of agriculture and some of the causes thereof, DYNEVOR ET AL. (*London: Land Union, 1922, pp. 17*).—A committee of The Land Union attributes the depression of British agriculture to decreased prices of agricultural products; increased prices on fertilizers, feeds, and necessities; high transportation charges, increased assessments on estates; income taxes; and death duties. Suggestions are that importation of foreign flour and barley be decreased, the excise duty on home-grown sugar reduced, income taxes, duties, and rates on agricultural property lightened, and other minor reforms carried out.

Agricultural progress in western India, G. KEATINGE (*London and New York: Longmans, Green & Co., 1921, pp. XI+253, figs. 5*).—The agricultural situation in western India is summed up to the effect that the majority of the farms are of the wrong size and shape and are neither permanent units nor susceptible of orderly and adequate improvement. The majority of farmers are deficient in skill, industry, and energy, and balance a low standard of endeavor by a low standard of living. Equipment is very defective as regards both implements and fixtures, such as sheds, barns, and fencing. Peculiar religious observances of the Hindus and social customs impede progress in cattle breeding and the derivation of profit from existing animals. It is deemed undesirable that the Government should pass legislation to parcel out the land into economic holdings of standard shape and size or dictate to the farmer what crops he shall grow.

Measures suggested amount to giving the landholder a chance of freedom from the operation of laws and customs which impede his progress. Gradual change in public opinion alone can effect liberation from the tyranny of caste, the working of the joint family system, and social and religious customs. It is held that land tenure should in general be of the peasant proprietor type, except perhaps in the case of sugar cane estates and dairy farms, and that the tendency toward subdivision and fragmentation should be checked. Legislation might be undertaken to prevent fraudulent practices in marketing, such as are found to exist in the cotton trade. Irrigation construction should be pushed. The cooperative movement and research, demonstration, and instruction should be encouraged and expanded with financial help, and cultivators should be encouraged to live on their holdings. The appointment of standing development commissions over suitable tracts is suggested.

The revision of the law relating to the encouragement of agriculture in Switzerland, E. LAUB and H. NATER (*Publ. Sec. Paysans Suisses No. 64 (1922), pp. 182*).—This is a digest of suggestions submitted by numerous agricultural organizations in Switzerland in answer to a questionnaire as to means of improving agriculture, especially by improving agricultural education, the live stock industry, and organization among producers.

The agricultural limits of our population, E. M. EAST (*Sci. Mo., 12 (1921), No. 6, pp. 551-557*).—The author estimates the maximum population that the United States can support on 800,000,000 acres of arable land as 331,000,000. If the United States would follow methods used in Japan, it is maintained that the ultimate maximum would be about 530,000,000, making allowances for differences in body weight, food habits, and diminished returns on some of the less productive areas.

Influence of power and machinery on social and physical conditions surrounding farm life, C. J. GALPIN (*Soc. Prom. Agr. Sci. Proc.*, 40 41 (1919-1920), pp. 22-26).—Two types of farmers, the so-called primitive muscular type and the new cerebral type of machine farmer, are contrasted. It is held that after the machine farmer becomes more like other men in the conduct of his occupation he will become more like other men in his institutions. Thus progress in the use of machinery and conveniences on the farm and in the farm home will materially modify rural habits of thought and action.

Cooperation in Czechoslovakia, L. F. DVOŘÁK (*Das Tschechoslowakische Genossenschaftswesen*, Prague: Ústřední Jednota Hospodářských Družstev, 1922, pp. 148, figs. 34).—The aims of agricultural cooperation are set forth as the furthering of the general interest in useful production with organized selling and elimination of unnecessary middlemen; the development of industrial independence for farmers, protecting them against exploitation by suppliers of agricultural necessities and implements; education of members; particularly in agricultural economics; the furnishing of much needed loans at reasonable rates, and raising the general standard of living among the agricultural classes. The organization, development, and present status of various phases of agricultural cooperation are described in detail.

Agricultural societies, R. G. CORMOVA (*Rev. Agr. Puerto Rico*, 8 (1922), No. 2, pp. 41-48).—The author describes the system of federated cooperative societies for production, marketing, and supplying credit in Porto Rico.

Report on the working of the cooperative societies in the Central Provinces and Berar for the year 1920-21, H. R. CROSTHWAITE (*Cent. Provs. and Berar [India], Coop. Soc's Rpt.*, 1920-21, pp. 6+19+1 A V V A).—This reports the number and progress of agricultural societies and related credit institutions.

The work of the agricultural society in Somalia, G. SCARFELLI-SFORZOLINI (*Agr. Colon. [Italy]*, 16 (1922), No. 3, pp. 89-98, fig. 1).—A brief report is given of the agricultural program in this region and of the progress of land-clearing operations.

Annual statistical report of the New York Produce Exchange for the year 1921 (*N. Y. Prod. Exch. Ann. Statist. Rpt.*, 1921, pp. 138).—Statistics of receipts and prices, freight rates, exports and imports, and visible supply of important agricultural commodities are given for 1921, with comparisons with preceding years.

The Price Current-Grain Reporter Yearbook for 1922, E. G. OSMAN (*Price Current-Grain Rptr. Yearbook*, 1922, pp. 112).—Current statistics are added to the series of reports previously noted (E. S. R., 45, p. 898).

AGRICULTURAL EDUCATION.

Some aspects of agricultural education in the United States of America, L. K. ELMHIRST (*Jour. Min. Agr. [London]*, 28 (1922), No. 11, pp. 982-988).—Extension teaching of agriculture and vocational agricultural instruction in the United States are briefly described.

Rural school survey of New York State, G. A. WORKS ET AL. (*Ithaca, N. Y.: Joint Com. on Rural Schools*, 1922, pp. 272, pls. 4, figs. 23).—This is the complete report on the survey previously noted (E. S. R., 47, p. 96).

[Agricultural instruction in Ireland, 1919 and 1920] (*Ireland Dept. Agr. and Tech. Instr., Ann. Gen. Rpt.*, 20 (1919-20), pp. 16-34).—The numbers of students enrolled and graduating at several agricultural colleges and schools in Ireland during the sessions of 1918-19 and 1919-20 are reported here. Notes are given also on itinerant instruction, demonstrations, short courses, and competitions.

The higher school of agriculture in Milan, B. MORESCHI (*Italia Agr.*, 59 (1922), No. 3, pp. 65-82, pl. 1, figs. 10).—An account is given of the inception of

this institution, its early directors and graduates, and some of its contributions to the progress of science.

Agricultural education in the Union (*Union So. Africa Dept. Agr. Jour.*, 3 (1921), No. 5, p. 397).—A scheme of agricultural education for the Union of South Africa as drawn up by a special committee in 1921 provides for a course of agricultural education calculated to reach all grades of scholars from the farm school, primary and secondary schools, and onward; includes the training of teachers; and coordinates the work of the present schools of agriculture, the various divisions of the Department of Agriculture, and the agricultural faculties.

Agricultural education, D. H. GRIST (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 2, pp. 122-130).—This is a brief statement of the activities of the Ceylon Government with regard to agricultural education, outlining the purposes and courses of instruction at the School of Tropical Agriculture at Peradeniya and noting training schools for native teachers, middle schools, school and home garden work, and cooperative societies, in so far as they contain suggestions for the organization of agricultural instruction in the Federated Malay States.

Economics and the community, J. A. LAPP (*New York: Century Co.*, 1922, pp. XIV+366, figs. 90).—Teaching material is presented which is intended to acquaint the student with economic problems of the community, including the production of raw material, distribution of manufactured goods, business organization, transportation, money transactions, labor management, agricultural problems, international trade, taxation, and others. A list of references is included.

Community civics and rural life, A. W. DUNN (*Boston: D. C. Heath & Co.*, 1920, pp. XII+507, pl. 1, figs. 167).—This is a text intended for use in instruction in citizenship in rural communities. It is designed for use in the grammar grades or in the first year of the high school. A list of readings is appended to each of the chapters.

Motion pictures for community needs, G. and H. BOLLMAN (*New York: Henry Holt & Co.*, 1922, pp. IX+298, figs. 13).—This book covers many practical details of the selection and presentation of motion pictures on church or school community programs. One hundred suggested programs are drawn up, and mechanical and legal information and directions are offered. Practical helps are given in the way of a list of various types of exchanges or distribution organizations; a bibliography listing magazines, trade papers, bulletins, catalogues, and books dealing with the exhibition of films; and suggestions for musical accompaniments.

A manual on junior agricultural clubs, C. W. BUCKLER (*Ky. Agr. Col. Ext. Circ.* 117 (1922), pp. 123, figs. 21).—Details of organization and management are set forth, and club projects, club courses, community club programs, contests and exhibits, county camps, and other forms of recreation are described.

Lessons for pig-club members, R. W. BLACKLOCK and H. G. CLAYTON (*Fla. Univ. Ext. Bul.* 31 (1922), pp. 44, figs. 21).—Lessons on the breeding, feeding, care, exhibiting, and judging of pigs are outlined.

First year poultry, E. WILSON (*La. Agr. Col. Ext. Circ.* 53 (1921), pp. 35, figs. 21).—An outline of poultry club work from October to September, inclusive, is given.

Sewing handbook for Montana clothing club girls, E. A. LINHOFF and R. PATCHIN (*Mont. Agr. Col. Ext. [Pub.]*, No. 53 (1921), pp. 59, figs. 20).—Lessons in textile, sewing processes, the use of patterns, and mending are outlined and illustrated.

First year sewing and cooking, M. S. GESELL and M. E. THOMAS (*La. Agr. Col. Ext. Circ.* 54 (1922), pp. 24, figs. 11).—Elementary courses in sewing and in cooking are briefly outlined.

Special methods course in home economics, E. I. RAITT (*Jour. Home Econ.*, 14 (1922), No. 5, pp. 223-226).—This outline contains the following subheads: Brief survey of the household in successive periods of the world's history, present status of the American home and its needs, the meaning of education for the student, home economics education, related subjects education, plant and equipment for home-making classes, bibliography, illustrative material and supplies, and the teacher.

A course in marketing, N. B. BAILEY (*Jour. Home Econ.*, 14 (1922), No. 5, pp. 220-222).—The course outlined here consists of a one-hour lecture period and two three-hour laboratory periods each week for one quarter. As laboratory exercises, specific foods are cooked and types of food are charged according to points in choice, price, number of servings per unit of weight, storage, value, and use. Canned goods are similarly studied. The lecture work covers problems of standardization of products, weights, measures, and containers, and marketing methods.

Alabama bird-day books (*Montgomery, Ala: Dept. Conserv.*, 1921, pp. 126, pls. 5, figs. 12; 1922, pp. 111, pls. 5, figs. 12).—A varied collection of prose and poetry about birds and their protection is offered in these annuals for use on bird-day programs in the schools.

MISCELLANEOUS.

Report of Alaska Stations, 1920, C. C. GEORGESON ET AL. (*Alaska Sta. Rpt. 1920*, pp. V+75, pls. 8).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1920. Meteorological data and accounts of the extensive tests with field and garden crops are abstracted elsewhere in this issue.

Fortieth Annual Report of New York State Station, 1921, R. W. THATCHER (*New York State Sta. Rpt. 1921*, pp. 40).—This contains the organization list, a review of the work and publications of the station, and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-fourth Annual Report of North Carolina Station, 1921, B. W. KILGORE ET AL. (*North Carolina Sta. Rpt. 1921*, pp. 80).—This contains the organization list, a report of the director and heads of departments, and a financial statement as to the Federal funds for the year ended June 30, 1921. The experimental work is for the most part abstracted elsewhere in this issue.

Thirty-first Annual Report of Washington College Station, 1921, E. C. JOHNSON ET AL. (*Washington Col. Sta. Bul. 167 (1922)*, pp. 64).—This contains the organization list, a report on the work of the station during the year, and a financial statement for the Federal funds for the fiscal year ended June 30, 1921, and the remaining funds for the fiscal year ended March 31, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue. A list of the bulletins and popular bulletins of the station since its establishment is appended.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 2, pp. 25-48, figs. 11).—In addition to several articles abstracted elsewhere in this issue, this number contains a brief article by A. Frank entitled *Potato Growers Are Urged to Spray with Bordeaux Mixture to Control the Late Blight of Potatoes*.

Index to the Yearbooks of the U. S. Department of Agriculture, 1911-1915, C. H. GREATHOUSE (*U. S. Dept. Agr., Index Yearbooks, 1911-1915*, pp. 178).—This is a combined subject and author index in continuation of work previously noted (*E. S. R.*, 29, p. 599).

NOTES.

Alabama College and Station.—Dr. L. E. Miles of the Mississippi Plant Board has been appointed associate professor of plant pathology and associate plant pathologist. Guy A. Hart, drainage engineer of the Bureau of Public Roads, U. S. Department of Agriculture, has been assigned to the department of agricultural engineering for surveys for tile drainage and terracing.

Hawaii University.—Extension courses were inaugurated about a year ago, including special classes, correspondence instruction, lectures, and miscellaneous service through expert advice, correspondence, and similar ways. Eight courses were given in Honolulu from September to June, with a total enrollment of 350 students, mostly mature men and women. These courses included applied horticulture, poultry husbandry, beekeeping, pineapple production, and several nonagricultural subjects. In addition a series of four lesson talks on dress-making was given to 200 women. The correspondence courses comprised 21 weekly lectures on elementary principles of agriculture, with an enrollment of about 200 persons.

Kansas College and Station.—Ground has been broken for the new veterinary hospital, a 2-story structure to cost \$100,000.

The station department of agricultural economics is cooperating with the American Food Research Institute, located at Leland Stanford University, in a study of wheat marketing in Kansas from the threshing machine to the central markets. H. I. Richards has been appointed assistant in marketing investigations in connection with this project.

Kentucky University.—Dr. James K. Patterson, president emeritus since 1910, died August 15, aged 89 years. President Patterson was a native of Scotland and graduated from Hanover College, Indiana, in 1856. He became connected with the Kentucky University in 1865 as professor of history and metaphysics, and served as president from 1869 to 1910. He was for years a familiar figure in the Association of American Agricultural Colleges and Experiment Stations, serving as president in 1903.

The will of President Patterson, after making a number of personal bequests, leaves the residuary estate in trust until it becomes large enough to yield an income of from \$35,000 to \$40,000 per annum, when the income is to be used to maintain the William Andrew Patterson College of the university. This college is to have for its purpose the training of young men for the diplomatic and consular service.

Rhode Island Station.—A. M. Shott, assistant chemist, has resigned.

Virginia Station.—DeWitt A. Tucker has been appointed assistant horticulturist, effective September 25.

Washington Station.—A new beef cattle barn 140 by 32 ft. with two 50-ft. wings and two concrete silos 14 by 36 ft., and a sheep barn 48 by 100 ft. with a 12 by 30 ft. wooden silo, have just been completed. The old cattle barn has been remodeled into a dairy barn, and the milk house enlarged and improved.

Dr. Paul W. Allen, formerly associate dairy bacteriologist in the Illinois University and Station and more recently engaged in commercial work, has been appointed bacteriologist, vice W. I. Nightingale, resigned.

EXPERIMENT STATION RECORD.

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No. 1

The importance to every experiment station of a working program adapted to the needs of its locality will hardly be questioned. Consciously or unconsciously most stations have been evolving such a program with more or less definiteness, which is expressed in a way in its organization and the list of projects it is pursuing. But less frequently has a permanent working plan been set forth to guide development and steady the course of the future.

It is interesting to note, therefore, that at the recent convention of the Association of Land Grant Colleges the Committee on Experiment Station Organization and Policy made this matter the subject of its report. It would be difficult to find one more worthy of its efforts or more desirable for consideration. The time too is opportune. Most of the stations are feeling the limits of their funds and must make a wise selection of the uses to which they are put. There is a quite general movement for larger support, and a well-matured program should be helpful in presenting needs and in emphasizing the importance of research.

As the committee pointed out, the plans of the stations in the past have to quite an extent been of short range, reflecting immediate demands or response to temporary conditions. Often too the individual preference of investigators has played a considerable part in shaping the lines of activity. Now, however, "the nature of the problems the stations have to meet is such as to require looking farther ahead and making careful preparations, as well as assuring continuance of the work. Of course there must always be provision for meeting emergency questions as they arise, and the trend of investigations can not be foreseen in detail; but this need not make the program of a research institution fortuitous or fragmentary in its larger aspects or haphazard in its planning."

The committee's suggestion is that each station consider carefully what it ought to attempt to contribute to the progress of agriculture in its State and in the Nation over a ten-year or a twenty-year period. "Even though there can be no time limit placed on research projects, and the progress of investigation or the nature of general agricultural development can not be prophesied, it may nevertheless be pos-

sible to set a goal and to shape permanent plans in accordance with the object in view. Furthermore, the time has come when no single station can hope to adequately attack all the many and difficult problems with which the agriculture of a given region is confronted, and the program of any given station ought to take into account the activity of other stations in the region. This can be successfully done only if each of the several stations concerned has a fairly definite program mapped out for its investigational work."

In considering the advantages of such a long-time program the committee presents these from the standpoint of the director, the individual research worker, and the general public. An organized plan, it is maintained, is the best possible basis for a convincing appeal for moral and financial support. It is a means of getting together with the constituency, and enlisting its support in carrying out plans devised in its interest. It is a way by which a station may express to the authorities of the college and to the public its mature judgment of the field that the station ought to occupy and the lines along which it should stress its investigations. The field which any station can cover and what it can attempt to do is dependent first of all upon the support it receives; and for its work to be thorough and conclusive assurance of continuity is necessary.

Furthermore, a definitely formulated program enables the director to determine upon the needed equipment and personnel, and the items which must be provided in its budget. Such a program offers a convenient measure of progress from year to year or from decade to decade. From one period to another it supplies a basis for judgment as to the adequacy of the station's efforts and progress in meeting the needs of the agricultural situation within the State and region.

From the standpoint of stability and continuity of investigation in the face of frequent changes of directors and working staff, a definite working plan and policy is of great advantage. As the committee points out, "far too few of the twenty or more present directors who have assumed their positions during the past two years have found in the records of their offices such a definite program of work as would make it possible to insure on their part an intelligent grasp of the present scope and policies of the station. Certainly the work of the station and the part which it is to play in the development of the agricultural welfare of the State are far too important to be made subject to the personal opinions or wishes of each new director or employee, and a definite continuous policy and program should be available as a basis for intelligent service in its behalf by the new men who come into the organization."

While opportunity should be preserved for the exercise of individual initiative and a reasonably wide range of freedom in research,

the committee maintains that such a program would be helpful and encouraging to the individual by contributing a larger measure of security for his investigation, and would guard against his needs being overlooked in the annual budget and plans. A fairly definite program would also discourage the impulsive undertaking of new studies and tend to hold attention to existing lines until they had been brought to a conclusion. And such a program would naturally make provision for coordinated effort, since as the committee remarks, "the time has come when the successful development of American agriculture demands scientific and organized study of many problems which are too broad in their scope to be attacked by single minds. . . . The pressure of modern science toward narrow specialization tends to limit the field of vision of the individual worker and to a degree to disturb his sense of proportion." The broadening influence of participation in a general plan or program is seen as one of the advantages to the individual worker, who will also often experience an added enthusiasm from the fact that his work is a part of a well considered and generally approved plan of public service.

For the general public a definite outline of work and development is held to be the only possible basis for an intelligent understanding of the place of the station in the State and national system of publicly supported institutions. "The preparation and submission of such a program to the consideration of organized associations of farmers within the State affords an opportunity for constructive criticism of station work by intelligent and experienced farmers who are to be the users of the results of the station's investigations, which is of the utmost advantage to both the people of the State, the legislature and the station officials."

Granting the desirability of such a mature program to cover a period of years, the question may be asked as to what it should attempt to do and how far it should undertake to go. According to the report of the committee, it ought to formulate somewhat definitely the best judgment as to what the station should attempt to contribute and the lines along which it should bend its primary efforts. It would outline the general fields of research in which it is proposed that the station shall engage, enumerate somewhat specifically the general nature of the projects to be undertaken in these fields, and present a statement of the facilities which are available or will be needed as additions, in order to make possible the satisfactory carrying out of the proposed program.

"The detail to which the discussion of any of these matters should be carried will vary with the different conditions which the program itself is designed to meet. And as a matter of expediency any public presentation of the program in printed form or otherwise

should always contain provision for its modification or expansion to meet emergencies which may arise, and such qualifications as to its binding effect upon the station or the State as experience in dealing with such matters may suggest."

In other words, it would not undertake to be a formally crystallized plan, all-comprehensive in its nature and inflexible in its provisions, but would be designed to serve as a general guide in the administration, development, and financing of the station. It should never be so inflexible as not to admit of improvement by amendment as new workers and new ideas become available to the station; but on the other hand it ought not to be interrupted or abandoned, in whole or in part, because of changes in personnel or as a result of personal preference of new additions to the staff. Evidently it ought not to be so specific or definitely limited as to become a hindrance rather than a help to the station's development in meeting the needs for agricultural research.

Latitude and elasticity will be secured by making such a program general rather than detailed, and by the provision that it will be subject to revision from time to time as circumstances require. But such a plan would have a substantial background in the present situation and the trend to be provided for, and represent a conscious effort to weigh and adapt the various lines of effort in accordance with their merits and relative importance. It would tend to direct the policy of a station along well-defined lines and to avoid the erratic results which may follow when programs are left largely to be developed out of passing conditions or individual suggestion. Of course, individuality must have reasonable play—not as a matter of impulse, but in carefully thought out plans; and in many cases these plans should have reference to the station as a whole rather than to a single department.

The idea of the unity of the station is essential to the making of any well-rounded program. As a public institution designed to work out the principles of action as related to practice in the agricultural industry, an experiment station is not merely an assembly of departments but a union of effort in which various departments are embraced. These departments are interrelated and are drawn together by the community of interest in broad questions, as well as by the general purpose. Their relationships are more readily discovered if there is encouragement to think outside of their immediate boundaries, and this will be an inevitable part of the construction of a long-time program.

Of course, there are exigencies and emergencies which can not be provided for in any such outline, as there are also a considerable number of short-time problems in most of the States. A frequent difficulty, however, is that these may be expanded out of proportion

to their importance because of the interest developed in them or around them in the course of their investigation. The basic plan should tend to minimize such difficulty and serve as a steadying influence in the face of waves of sentiment or conditions which are taken for emergencies.

As to the way in which such a program should be made, the committee points out that it should be "based on a careful survey of (a) the probable development of agriculture in the State during the period to be covered by the program, and the problems which are likely to arise because of this development; (b) the proper place of the experiment station among the various State agencies for the promotion of the interests of agriculture; and (c) the relation of the activities of the individual station to those in adjoining States which serve the same general agricultural region and have, therefore, similar problems as possible factors in their program of work."

Evidently such a plan can not be the product of a single man, but ought to enlist the assistance of experts in many lines, to provide as nearly as possible a complete survey of the situation which the station has to face and the needs which it should fill. While it is the duty of the station director and his staff to assume leadership in planning for the future development of agricultural research, it is suggested that the farming constituency of the station may be helpful, even in the initial stages, and that such a program ought to be submitted to the test of their experience and intelligence before it is finally adopted.

While it is too much to expect that any group can accurately foresee all the changing conditions which may affect the agriculture of a State or region during the period to be covered by such a program, "every experiment station staff has a group of men who have occupied positions of responsibility and leadership in the State's agriculture for many years, and who by training and experience are at least as fully qualified to predict future development as are any other similar group within the State. The combined wisdom and judgment of these men ought to be brought to bear upon the problem of the future development of the station's program." And with this information as a background the director would be able to weigh recommendations and give proper proportion to the various features involved in a developmental plan.

It will be evident that the making of such a program calls for rigid self-examination, an impartial attempt to assess the importance and the adequacy of the station's various efforts and its ability to meet the needs of the future. It can not be made hastily; it requires time for study and consultation. The views of those engaged in it will need to be harmonized, and individual lines to be fitted into the

work of the station as a whole. To only a limited extent can this be delegated to a committee or a group; in the end the director must exercise a decisive influence, and he must be in position to defend the program as a whole.

The preparation of such a working and developmental plan will be recognized as more feasible now than when the stations were younger. Their work has a greater degree of security and permanence than formerly, and there is a larger background on which to rest more expansive plans. This gives greater ability in anticipating lines along which to plan profitable development.

The stations are stable institutions. There is every reasonable expectation for their development and growth. Their main lines of activity are now less subject to interruption or interference from without than they are from within their organization. True, their appropriations may be reduced or not grow with the needs for their activity, but the more fundamental changes affecting the carrying out of pieces of investigation are likely to result from internal change in management and personnel or failure to conserve resources.

Because the station is a continuing institution whose work properly done takes time, and because research must increasingly serve as the chief guide in the whole scheme of agricultural progress, the experiment station can not avoid taking thought for the future and formulating its plans for a considerable period in advance. In some of the newer fields we need to be learning how to investigate, to prepare for the questions which are already upon us. Of all branches of the college the station can least of all afford to be drifting with the tide, depending upon circumstances, subjective to immediate conditions. Its course and its attitude must be objective, considered, matured, exhibiting both vision and initiative.

The work of the future will not be like either that of the past or the present. It will advance. The direction which this should take may be suggested by a scrutiny of the trend of affairs and of conditions, an insight which the progress of science is making more possible. Unless this can be done and plans laid with a reasonable degree of forethought, the station's career as a research institution will be subject to fluctuations arising from temporary circumstances, and the net results less conclusive and satisfying than should be the case.

Experience has shown that it is possible for the work of individual departments to be good and worth while without the station as a whole presenting as strong a front and serving the State as effectively as it might in the long run. Its efforts may be fugitive, disjointed, serving only the present, not guided by any comprehensive plan. It may be responsive to no leadership and represent no cohesion or common impulse.

The usual research institution outlines its field and what it will attempt to do. It recognizes certain limitations which will hold it within bounds, and it attempts to define those bounds in a general way to the best of its judgment, selecting the things which prospectively seem most important. If other resources come to it, it may be able to broaden the range of its activity, either by supplementing existing effort or entering upon new lines.

This applies with equal force to the experiment station. Because it has attempted to be responsive to public demands and has rarely had a definitely assured budget, it has given less attention than some classes of institutions to the outlining of a future program. The Committee on Experiment Station Organization and Policy has rendered a useful service in calling attention to the desirability of such a program at this time, and its recommendations are entitled to the serious consideration of administrative officers.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The chemistry of nonbenzenoid hydrocarbons and their simple derivatives, B. T. BROOKS (*New York: Chem. Cat. Co., Inc., 1922, pp. 612, figs. 8*).—In this monograph on the aliphatic and cyclic nonbenzenoid hydrocarbons, the author "has endeavored to show the close relationships which hold generally throughout the chemistry of the nonbenzenoid hydrocarbons, and on the other hand to point out that the chemical behavior of the more complex hydrocarbons of the paraffin series and the alicyclic hydrocarbons can not be assumed from the chemical behavior of a few of the simpler hydrocarbons. The chemistry of the ethylene bond is emphasized because of its great importance, and because most of our knowledge of its behavior under different circumstances and influences is empirical."

Evidence of a structure in gelatin gels, R. A. GORTNER and W. F. HOFFMAN (*Soc. Expt. Biol. and Med. Proc., 19 (1922), No. 5, pp. 257-264, figs. 4*).—Evidence is presented in this contribution from the Minnesota Experiment Station that "gelatin gels have a structure and that this structure is more or less fixed at the time that gelation takes place."

Clay as an ampholyte, O. ARRIENIUS (*Jour. Amer. Chem. Soc., 44 (1922), No. 3, pp. 521-524, fig. 1*).—Data are given in the form of tables and curves on the rate of settling of clay suspensions in comparison with their hydrogen-ion concentration. Two clay soils, one of pH 7.5 and the other of pH 5.0, were used in making the suspension. In each case 100 gm. of clay was suspended in 5 liters of water and 250 cc. portions of the suspension were placed in glass cylinders. Acid or alkali was then added and the suspension in each case made up to 350 cc., well shaken, and allowed to settle. During this time the heights of the clear column of liquid were measured at definite intervals.

The curves constructed from the data obtained from the two soils were very similar. With decreasing acidity there was a decrease in the rate of settling, followed by a sharp increase until the isoelectric point was reached, when there was a more or less steady fall until the settling rate reached the minimum, after which at high alkalinity the rate increased rapidly.

It is pointed out that these curves are almost identical with those of gelatin, and thus indicate that clay is an ampholyte, and can therefore combine with either acid or base.

The hydrogenation of oils, E. B. MAXTED (*Chem. Age [London], 6 (1922), No. 150, pp. 542-545, fig. 1*).—This is a discussion of the modern development of the process of hydrogenating oils. The principal points considered are the temperature of the reaction, the rôle played by oxygen, catalysts, catalyst poisons, modern tendencies in machinery for hydrogenation, and uses of hardened oils.

Preparation of chaulmoogra oil derivatives for the treatment of leprosy, A. L. DEAN and R. WRENSHALL (*Pub. Health Rpts. [U. S.], 37 (1922), No. 23, pp. 1395-1399, fig. 1*).—A brief description is given of the routine methods used

at the University of Hawaii for making certain derivatives of chaulmoogra oil for therapeutic purposes.

Xylenol blue and its proposed use as a new and improved indicator in chemical and biochemical work, A. COHEN (*Biochem. Jour.*, 16 (1922), No. 1, pp. 31-34).—A new sulphonaphthalein indicator, which is said to have practically the same properties as thymol blue with the exception that it is twice as intense in color, has been prepared by replacing the thymol residue in thymol blue with *p*-xylenol, which can be easily prepared from diazotised *p*-xylylene. The new indicator, *p*-xylenol sulphonaphthalein or xylenol blue, has two working ranges of utility from pH 1.2 (red) to 2.8 (yellow) and from pH 8 (yellow) to 9.6 (blue).

A simple bubbling hydrogen electrode, J. R. HAAG (*Science*, n. ser., 55 (1922), No. 1426, pp. 460, 461, fig. 1).—The electrode vessel in the apparatus described is made from a 3-in. soda lime tube to the end of which is fused a piece of glass tubing, bent to make a wide arm parallel to the main tube. The electrode proper consists of a piece of platinum foil, sealed as near the base of the bulb as possible. An ordinary beaker is used for the potassium chlorid solution, in which are placed the side arm of the calomel electrode and a bent glass tube filled with saturated potassium chlorid and leading into the side arm of the hydrogen electrode. The end of this connecting tube is drawn out to a small opening, which is plugged with paper to prevent too rapid siphoning of the saturated potassium chlorid into the electrode. After the electrode is platinized, about 1.5 cc. of the solution to be tested is put into the electrode vessel and purified hydrogen is bubbled through the solution by means of the side arm. About three minutes of bubbling is generally sufficient for saturation.

The apparatus is recommended on account of simplicity of construction, ease of operation, and the small amount of solution required for a determination.

The Clark hydrogen-electrode vessel and soil measurements, D. J. HEALY and P. E. KARRAKER (*Soil Sci.*, 13 (1922), No. 5, pp. 323-328).—Determinations are reported of the H-ion concentration of fresh and dried soils by the use of the Clark hydrogen-electrode apparatus and also by the colorimetric method of Wherry (*E. S. R.*, 44, p. 418). The air-dried soils measured electrometrically showed a slightly greater H-ion concentration than when measured in the fresh condition, and a distinctly greater H-ion concentration than when measured by Wherry's method.

Factors influencing the determination of sulphates in soil, C. T. HIRST and J. E. GREAVES (*Soil Sci.*, 13 (1922), No. 4, pp. 231-249).—This contribution from the Utah Experiment Station consists of a review of the literature on the determination of sulphates, and an investigation of the relative merits of the barium sulphate gravimetric and the chromate volumetric methods of determining sulphates in soils and of various points in the technique of soil sulphate determinations.

In a preliminary study of the recovery of sulphates from pure solutions of known concentration, it was found that the chromate volumetric method consistently recovers smaller quantities of sulphates than the gravimetric method, but that the most nearly concordant results are obtained with solutions of about normal concentration. The effect of various soluble salts on the recovery of sulphate by the two methods was determined by adding varying amounts of approximately 2*N* solutions of the chlorids of sodium, potassium, aluminum, and iron to 10 cc. of approximately *N* sulphuric acid, and determining the sulphate ion gravimetrically and volumetrically. Sodium chlorid had a slightly depressing and potassium a more noticeably depressing effect. Aluminum and iron caused a positive error with the gravimetric and a negative

with the volumetric method. Nitrates of the same elements produced a more marked effect, the errors being positive in the case of sodium and potassium nitrate by both methods, positive for aluminum by the gravimetric and negative by the volumetric, and negative for iron by both methods.

With the particular soil examined a ratio of 1 part of soil to 5 parts of water gave satisfactory extraction. A longer time of agitation was required to reach equilibrium in soil solutions in which sulphates are to be determined than had previously been found to be necessary with chlorids or nitrates. The Chamberland filter or the centrifuge proved satisfactory for the clarification of the soil. As in the case of simple sulphate solutions, the chromate volumetric method recovered smaller quantities of sulphates than were obtained by the gravimetric method. It is concluded, however, that since the chromate volumetric method is considerably more rapid than the gravimetric, it may well be used where a large number of sulphate determinations are to be made, provided a correction be applied for the presence of aluminum, iron, and nitrates.

A new method for the volumetric determination of copper, S. MINOVICI and A. JONESCU (*Ann. Chim. Analyt.*, 2. ser., 4 (1922), No. 4, pp. 99-102).—The method described is based upon the reaction between ammonia and copper salts, resulting in the formation of ammoniacal cupric sulphate, $\text{Cu}(\text{NH}_3)_4\text{SO}_4$. On treating this with alcohol at 98° C., it is precipitated as a crystalline bluish-violet powder, which on filtration and washing with alcohol can be dissolved in water and titrated with sulphuric acid or oxalic acid. Methyl red in 0.20 per cent solution in alcohol has been found to be the most satisfactory indicator. The method is said to be quantitative, easy of execution, and capable of being applied to mixtures of copper salts with other salts which do not react with ammonia and are neutral to indicators.

The amino acids of flesh.—The diamino acid content of rabbit, chicken, ox, horse, sheep, and pig muscle, J. L. ROSEDALE (*Biochem. Jour.*, 16 (1922), No. 1, pp. 27-30).—Determinations made by the Van Slyke method of the diamino acids of the proteins of the flesh muscle of the rabbit, chicken, ox, horse, sheep, and pig are reported and discussed. The red meats with the exception of mutton were higher in lysin than the white meats. The arginin figures were quite constant at about 14 or 15 per cent of arginin nitrogen. The histidin figures were not very satisfactory, showing great variation.

The estimation of pectin as calcium pectate and the application of this method to the determination of the soluble pectin in apples, M. H. CARRÉ and D. HAYNES (*Biochem. Jour.*, 16 (1922), No. 1, pp. 60-69).—A study of the influence of various interdependent factors upon the precipitation of pectin as calcium pectate is reported, the results of which have led to the adoption of the following method of estimating pectin:

An amount of extract which will yield from 0.02 to 0.03 gm. of calcium pectate is neutralized and diluted to a volume such that the total volume after the addition of all reagents will measure about 500 cc. After 100 cc. of N/10 NaOH has been added the mixture is allowed to stand at least an hour but preferably over night, after which 50 cc. of N acetic acid is added, followed after 5 minutes by 50 cc. of M CaCl_2 . After an hour the mixture is boiled for a few minutes, filtered through a large fluted filter, and the precipitate washed with boiling water until the filtrate is free from chlorin. The precipitate is then washed back into the beaker, boiled and filtered again, and the process repeated until the filtrate from the boiled precipitate gives no test for chlorin with silver nitrate. It is finally filtered into a small fluted filter, from which it can be transferred to a Gooch crucible previously dried at 100° C. The precipitate is dried to constant weight at 100°, a process generally requiring

about 12 hours. It is emphasized that the above proportions and technique must be followed carefully to obtain quantitative precipitation of the pectin, but that it is possible to work with solutions of a dilution much beyond the limits of the precipitation of pectin with alcohol.

Analyses of the calcium pectate thus precipitated have been made by ignition to CaO and by conversion to the sulphate. The average percentage of calcium in five determinations was 7.612 for the former and 7.654 for the latter. The mean of the two series, 7.63, agrees closely with the theoretical percentage of calcium (7.66) in calcium pectate if pectic acid has the formula $C_{17}H_{22}O_{10}$ previously obtained (E. S. R., 37, p. 309). It is concluded, therefore, that calcium pectate obtained by this method is a definite chemical compound, the empirical formula of which approximates closely $C_{17}H_{22}O_{10}Ca$.

Notes for food chemists, P. HASSÉ (*Chem. Ztg.*, 46 (1922), No. 31, pp. 233-234).—Methods are described for determining vanillin in vanillin sugar by optical refraction, using a Zeiss milk refractometer, and for detecting nitrobenzol in benzaldehyde. The latter test depends upon the property of aldehydes of uniting with bisulphite to form a compound which has not the characteristic odor of the aldehyde. If the substance is nitrobenzol the original odor is retained.

The chemical examination of preserved fish, G. HINARD (*Ann. Falsif.*, 15 (1922), No. 160-161, pp. 72-79).—In an effort to discover methods of detecting incipient spoilage in canned fish, a study was made of the nitrogen evolved under various conditions during the course of canning and on subsequent storage.

Prolonged heating at a temperature of 115° C. and in a faintly acid medium had no more effect on dissolved nitrogenous matter than boiling for a short time at ordinary pressure. The ratio of ammoniacal to total dissolved nitrogen was found to give no indication of the condition of the product. It is concluded that nitrogen determinations are of no value in judging the quality of canned fish.

Determination of eggs in food pastes, E. VAUTIER (*Mitt. Lebensmtl. Untersuch. u. Hyg., Schweiz. Gesundheitsamt.*, 13 (1922), No. 1-2, pp. 63-66).—Attention is called to the fact that the method of detecting eggs in food paste by phosphorus determination, as in the method of Arragon (E. S. R., 17, p. 1135), serves only to detect the presence of egg yolk. A method is described for determining egg white in such products, this serving to supplement the other test.

The method consists in determining the total albuminous material precipitable and coagulable by heat in a concentrated solution of magnesium sulphate and insoluble in boiling water. The technique of the method is described in detail, and data are given as to its application in commercial foodstuffs, with and without eggs, and in products prepared in the laboratory from skim milk, with and without eggs. Skim milk alone gave 1.1 per cent albumin by this method, the same amount of skim milk with one egg 1.3, with two 1.7, and with three 2.1 per cent.

Bottled beverages and soda fountain sirups, W. W. SKINNER (*Amer. Jour. Pub. Health*, 12 (1922), No. 6, pp. 487-493).—A brief description is given of the ingredients of bottled sodas and of the sirups used in the preparation of soda fountain beverages. The sirups are classified as the cola type, the fruit or imitation fruit type, and a miscellaneous type to the members of which distinctive names are generally applied. The possible adulterants of the sirups and their regulatory control under the Federal Food and Drugs Act are also discussed.

Titration methods for the determination of milk phosphates and their application to the valuation of milk, W. MÜLLER (*Mitt. Lebensmtl. Untersuch.*

u. Hyg., Schweiz. Gsundtsamt., 13 (1922), No. 1-2, pp. 52-63).—As a criterion for the detection of abnormal milk from pathological udders, the author recommends the determination of the P_2O_5 content of the milk serum by the titration method of Ambühl and Weiss,¹ in which the phosphate in the serum is precipitated with uranium nitrate and the excess reagent titrated with potassium ferrocyanid. In the case of normal milk the P_2O_5 content of the serum lies between 24 and 32 per cent of the ash, while in pathological secretions from abnormal udders it was found to vary from 5.7 to 20.6 per cent of the ash.

A method for the rapid determination of urea in minute amounts of blood. I. S. KLEINER (*Soc. Expt. Biol. and Med. Proc., 19 (1922), No. 5, pp. 195-197*).—The method involves the digestion of urea by urease, the precipitation of the proteins by the Folin-Wu method, the direct nesslerization of the filtrate, and the determination of the color in the microcolorimeter previously noted (*E. S. R., 44, p. 614*). The technique of the method is described, and tables are given showing the averages of many determinations by the method. The results obtained, using only 0.2 cc. of blood, agree closely with analyses of the same specimens by the aeration method in which 2 cc. of blood were used.

The estimation of total sulphur in urine. R. ROBISON (*Biochem. Jour., 16 (1922), No. 1, pp. 134-136*).—To avoid spattering in the determination of total sulphur in urine by oxidation with copper nitrate and potassium chlorate, as recommended by Benedict,² the author suggests the use of copper chlorid as a diluent of the copper nitrate, the oxidizing reagent consisting of 40 gm. crystallized copper nitrate and 15 gm. of copper chlorid made up to 100 cc. with water. Of this solution 2.5 cc. is added to 10 cc. of urine in a 4-in. porcelain evaporating dish and the solution evaporated to dryness on a water bath or electric hot plate. The oxidation is then continued by heating over a broad alcohol flame for 20 minutes. The residue is dissolved in 10 cc. of 2N HCl and diluted with 300 cc. distilled water, and the sulphate is precipitated in the boiling solution with 10 cc. of a 5 per cent solution of barium chlorid added slowly from a drop tube. The precipitate is allowed to stand over night before being filtered.

The utilization of residues in the form of food and feeding stuffs, as fertilizers, and in agricultural industries in general (1914-1920). A. BRUTTINI (*Ramassage et Utilisation des Déchets et Résidus pour l'Alimentation de l'Homme et des Animaux pour les Engrais et les Industries Agricoles (1914-1920)*). Rome: *Inst. Internatl. Agr., 1922, pp. 336, figs. 17*).—This monograph consists of a valuable summary of the efforts made during the World War to increase the materials suitable for human food, animal feeding stuffs, and fertilizers through the utilization of new materials and of so-called waste products. The subject matter is divided into two parts, the first of which deals with the legislative and administrative methods adopted by Germany, Great Britain, France, and Italy, and to a lesser extent by other countries for increasing available foods and feeding stuffs through the use of various substitutes.

In part 2 are discussed in considerable detail the technical treatment and utilization of a great number of waste materials, with particular emphasis on methods developed during the war emergency. The section on human foods deals largely with substitutes for flour, tea, coffee, spices, and meat, wild plants suitable for food, by-products and residues of the dairy industry, and substitutes for common edible oils. This is followed by similar sections on feeding

¹ Mitt. Lebensmitl. Untersuch. u. Hyg., Schweiz. Gsundtsamt., 10 (1919), No. 2, pp. 53-75.

² Jour. Biol. Chem., 6 (1909), No. 4, pp. 363-371.

stuffs and fertilizers, and a final chapter on the manufacture of alcohol, oils, and other industrial products from various residues.

A study of sweet potato varieties, with special reference to their canning quality, C. A. MAGOON and C. W. CULPEPPER (*U. S. Dept. Agr. Bul. 1041* (1922), pp. 34, pls. 3).—The investigation reported in this publication covered a period of three seasons, during which various problems connected with the canning of sweet potatoes were studied, methods of canning standardized, and over 40 varieties of sweet potatoes tested for comparative canning qualities. In these tests the steamed and peeled potatoes were canned as nearly whole as possible and also after being passed through a meat grinder to obtain a uniform material.

It was found that the tendency of the cooked potato to darken on exposure to air could best be overcome by packing the cans as full as possible at a temperature of 80° C. or above and sealing and processing at once. The immediate processing is considered advisable largely on account of the physical character of the sweet potatoes, which causes penetration of heat into the mass to be very slow. Processing at high temperatures and for a long time was found to injure the flavor of the product through the caramelization of some of the sugar. Good results were obtained when the potatoes were processed at 116° for a length of time sufficient to bring the material at the center of the can somewhat above 100°.

Plasticity tests of the canned products when compared with chemical analyses showed that the consistency of the product is due largely to the nature of its carbohydrate content. The varieties which remained firm after cooking contained a high percentage of starch, while those which became soft had a low percentage of starch and a comparatively high percentage of dextrin. The changes which take place in the potatoes after digging are probably of the same order. When the canning is done immediately the product is invariably firmer but somewhat less sweet than when the potatoes are placed in storage before being canned. The differences in respect to firmness and sweetness of the individual varieties are also considered to be due largely to the proportion of starch and dextrin present. In this connection it is suggested that the difficulties experienced by Mangels and Prescott in obtaining a satisfactory sweet potato flour by the flake process (*E. S. R.*, 45, p. 416) were largely due to the varieties used and the time, late winter, of making the test.

A descriptive list is given of the varieties and strains of potatoes used in the investigation, the points especially considered being the peeling quality and color of the cooked potato, the consistency of the raw potatoes when freshly dug and after curing and storage, the tendency to darken, and the canning quality. Of the varieties tested, Gold Skin was awarded first place for two consecutive seasons by the committee judging the quality of the product. The Yellow Jersey, Early Red Carolina, and Big Stem Jersey represented the best of the dry firm types; the Dooley, Porto Rico, Nancy Hall, Mullihan, and Vineless Pumpkin "yam" the deep-colored moist group; and the Belmont, Miles, and Yellow Strasburg the lighter-fleshed, medium moist type.

Fruit products (*California Sta. Rpt. 1921*, pp. 67-74).—In continuation of work previously noted (*E. S. R.*, 44, p. 714), brief reports are given of progress in studies on the utilization and preservation of fruit. Suggested methods of utilization of fruit juices include the preparation of juices for use in the manufacture of carbonated beverages, and of jellies and marmalades. Preliminary experiments by W. V. Cruess and Irish have shown that fresh juices kept in freezing storage retain their color and flavor until used in the preparation of carbonated beverages, and that these beverages can be sterilized at 140° F.

without subsequent loss from molding or fermentation or appreciable injury to the flavor. In the case of strawberry and raspberry juices, it is necessary to reinforce the color by the addition of a sirup or juice made from grapes or other highly colored fruit.

Previously reported results on the suitability for jelly making of canned citrus fruit juice (E. S. R., 47, p. 509) have been confirmed, and good results have also been obtained with the canned juices of currants, apples, loganberries, and blackberries. It is stated that for successful results the juice should be rich in pectin as shown by the alcohol test, and should have an acidity of at least 1 per cent. In some cases the juices have been found to be in excellent condition after a period of three years.

Several uses for cull pears are suggested. A sirup of rich "baked" pear flavor has been prepared from pears unsuitable for canning or fresh shipment. The sirup is prepared by crushing and pressing the fruit in an apple crusher and press, boiling the juice with infusorial earth, filtering, and concentrating, either in an open or vacuum pan to a concentration of 60° Balling, and finally pasteurizing it. About 20 gal. of sirup can be made from a ton of fresh fruit.

It has also been found possible to prepare an excellent pear butter from sound cull pears. The peeled fruit is cooked for a short time and then rubbed through a fine screen. To each pound of fresh pulp 2 pints of fresh pear juice is added and the mixture concentrated to the consistency of apple butter after the addition of cloves and cinnamon. Another formula consists of 100 lbs. of pear pulp, 2 qt. of lemon juice, and 2 oz. each of ground cinnamon, cloves, and ginger. Sun-dried pears can also be converted into a butter by soaking the pears overnight in water, boiling until tender, screening out the seeds and fiber, and concentrating with sugar and spices to a thick consistency.

Another use that can be made of cull pears is in the manufacture of vinegar. The fruit is crushed and pressed and the juice fermented with a selected cider yeast, after which a starter of strong cider vinegar is added and the barrel containing the liquid left at room temperature for about three months. It is stated that a ton of cull pears will yield about 140 to 150 gal. of finished vinegar of about 4.5 per cent acetic acid content.

A method of preparing lemon sirup by a freezing process has been developed by P. E. Sharpless. The sirup is prepared by freezing the fresh juice, crushing the ice, and separating the concentrated juice from the ice by means of a centrifuge provided with a perforated basket. It is stated that the sirup retains its flavor very well when kept in cold storage but deteriorates rapidly when held at room temperature. A grape sirup of superior flavor and color has also been made by this process.

The experimental work on fruit dehydration has been previously noted from other sources (E. S. R., 45, p. 808; 46, p. 509).

Olive canning and pickling (*California Sta. Rpt. 1921, pp. 77-79*).—In addition to data previously noted on the effect of high temperature sterilization on the quality of olives (E. S. R., 44, p. 762), an investigation by Maher of the cause of the green coloration which sometimes develops in canned olive oil is noted briefly. The color was found to be due to excess of soldering flux left in the can. A thorough washing and drying of the cans before use was found to remedy this difficulty.

Home preservation of fruit juices, H. L. TWEED (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, p. 146).—Brief directions are given for the preservation of homemade sweet cider by pasteurization and by the addition of a preservative such as sodium benzoate.

METEOROLOGY.

Some tendencies in climatology during the past decade, R. DE C. WAER (*Bul. Amer. Met. Soc.*, 3 (1922), No. 2, pp. 19-21).—The tendencies reviewed in this paper are (1) the increasing emphasis which is being laid upon practical or applied as distinguished from pure or theoretical climatology, especially along the line of bioclimatology; (2) the greater emphasis which is being laid upon the variability, frequency, and probability of occurrence of the various climatic elements, with correspondingly less limitation to the simple but fundamental mean or average values; (3) the tendency to lay more and more emphasis upon weather as essential to a proper understanding of climate; and (4) the increasing practical recognition of the fact that for sound climatological knowledge it is essential that all data should be homogeneous and should cover or be reduced to the same period of time.

A method for the calculation of normal frost dates from short temperature records, W. B. VAN ARSDEL (*U. S. Mo. Weather Rev.*, 50 (1922), No. 6, pp. 297-301, figs. 5).—In the method proposed the occurrence of a minimum temperature of 32° F. or below is taken as the equivalent of a killing frost. Then from the available data the smoothed curve of normal daily minimum temperature is drawn, and the dispersion of actual minima about the mean minimum is determined. From this it is possible to calculate such data as probable dates of first and last frost and length of growing season in four out of five years.

"The fundamental idea on which the method is based is that the 'average' date of, say, the first killing frost in the fall is the mean abscissa of a curve whose ordinates represent the joint probability that frost will occur and that it shall not previously have occurred (since spring); in other words, the probability that the first frost will occur, plotted against date, is the same curve as the frequency distribution of first frost over, say, a 100-year period, and will correspond to the same average date. It should be noted that given two stations with identical normal daily minimum temperature curves, frost will occur first at the station where actual temperatures disperse most widely about the mean."

Temperature minima at 5 cm. above the earth, G. SCHWALBE (*Met. Ztschr.*, 39 (1922), No. 2, pp. 41-46).—Data are reported which show that the number of frost days are decidedly higher at 5 cm. above the surface of the soil than at a height of 2 meters.

Evaporation and precipitation of the earth, G. WÜST (*Ztschr. Gesell. Erdk. Berlin*, 1922, No. 1-2, pp. 35-43).—The more important contributions to the computation of the water economy of the earth are reviewed. The results are summarized in the following table:

Computations of the water economy of the earth.

[Amounts in 1,000 cu. km. per year.]

Distribution.	Precipitation according to—			Evaporation according to—		
	Fritzsche-Brückner.	Schmidt-Fritzsche.	Wüst-Fritzsche.	Fritzsche-Brückner.	Schmidt-Fritzsche.	Wüst-Fritzsche.
On the sea.....	353.4	242.4	267.1	384.0	273.0	304.2
On land.....	111.9	111.9	112.1	81.3	81.3	75.0
For the whole earth.....	465.3	354.3	379.2	465.3	354.3	379.2

On the correlation between the fluctuation of the sunspots area and the terrestrial precipitation, S. KUNITOMI and H. TAKÔ (*Bul. Cent. Met. Observ. Japan*, 3 (1921), No. 3, pp. 95-125, pls. 10, figs. 3; *abs. in Sci. Abs., Sect. A—Phys.*, 25 (1922), No. 292, p. 273).—A study of data, mainly for one year only, on sun spots or faculae and precipitation in Japan is stated to afford evidence of a parallelism, although the correlation coefficients are very small.

Relations between rainfall, temperature, and the yield of wheat, N. A. HESSLING (*Min. Agr. Argentina, Ofic. Met. Bol. Mens.*, 4 (1919), No. 4, pp. 189-197, fig. 1; *trans. in U. S. Mo. Weather Rev.*, 50 (1922), No. 6, pp. 302-308, fig. 1).—This article reviews the available data bearing on the relation of rainfall and temperature to the yield and specific weight of wheat in Argentina, and discusses the possibility of computing the yield by means of the meteorological elements.

It is pointed out that the rainfall of the Republic is, as a rule, sufficient for a good yield of wheat, although the yield is occasionally reduced by partial droughts in one or more of the Provinces. The rainfall giving the highest yield is about 100 mm. in June and July and 100 mm. more in September and October.

"In general the yield seems to be more or less inversely proportional to the temperature, which fact allows the relation between temperature and yield to be expressed by the correlation coefficient, a simple and practical method, but which could not be employed in the case of the rainfall, because between the rainfall and the yield there is no linear correlation. . . .

"The correlation between the temperature and the yield of wheat is so close that with this element alone it is possible to forecast with a fair approximation the resulting crop. As the yield is more or less inversely proportional to the mean temperature of the months August to November, a constant would have to be found, that, multiplied by the temperature or by the departures from the normal, would give the yield. This constant, called gener-

ally 'regression factor,' can be computed by the formula $b = \frac{\sum xy}{\sum x^2}$, in which

b is the regression factor, x the causative variable, in this case the temperature, and y the resulting variable, in this case the yield. For the whole country b results = -208 for the months of August to November, that is, for each degree that the mean temperature of those months is higher or lower than the normal, the yield of wheat will diminish or increase respectively 208 kg. per hectare [185 lbs. per acre]."

The data show that the specific weight, as well as the yield, of wheat varies from year to year, but "analyzing these data with respect to the rain and temperature does not reveal any relation with these elements, excepting that the greater specific weight corresponds in general to the scantiest rainfall."

A contribution to the study of the rainfall map of South Africa, J. R. SUTTON (*Roy. Soc. So. Africa Trans.*, 9 (1921), pt. 4, pp. 367-414, pls. 13).—The mean monthly and annual rainfall at 567 stations in South and East Africa having records of 10 years or more is shown in tables and maps, and is briefly discussed with reference to the more important contributions to the subject and summarized for each Province. The latitude, longitude, and altitude of the various stations are given.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 50 (1922), Nos. 5, pp. 229-280, pls. 17, figs. 12; 6, pp. 281-340, pls. 8, figs. 10).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for May and June, 1922, and bibliographical information, reprints,

reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 5.—An Aerological Survey of the United States.—I, Results of Observations by Means of Kites (illus.), by W. R. Gregg (abs.); Relation Between Rate of Movement of Anticyclones and the Direction and Velocity of Winds Aloft (West and Southwest of Highest Pressure), by C. L. Mitchell; High-level Isobars as Used in Everyday Weather Service, by R. Sekiguchi; Vertical Distribution of Air Currents in Different Parts of Cyclones and Anticyclones, by P. Molchanov, trans. by E. W. Woolard; The Meteorological Aspects of the Thirteenth National Balloon Race (illus.), by V. E. Jakl; Bumpy Flying Conditions Along the Atlantic Coast (illus.), by A. W. Parkes; The Austin Tornado of May 4, 1922 (illus.), by F. Morris; Some Observations Made on the Origin, Growth, and Disappearance of the Tornado which Passed West of Austin May 4, 1922, by P. T. Seashore; Tornado Frequency in Kansas, by S. P. Peterson; and Dry Season, 1921–22, in the Canal Zone, by R. Z. Fitzpatrick.

No. 6.—The Local, or Heat, Thunderstorm (illus.), by C. F. Brooks; The Topographic Thunderstorm (illus.), by C. Hallenbeck; Tropical Cyclones in Australia and the South Pacific and Indian Oceans (illus.), by S. S. Visher; Tropical Cyclones in the Northeast Pacific, Between Hawaii and Mexico (illus.), by S. S. Visher; A Method for the Calculation of Normal Frost Dates from Short Temperature Records (illus.), by W. B. Van Arsdel (see p. 615); Dust Over the North Atlantic, by W. E. Hurd; Relations Between the Weather and the Yield of Wheat in the Argentine Republic (illus.), by N. A. Hessling (see p. 616); The Rainfall of Venezuela (illus.), by A. J. Henry; Concerning the Halo of 46°, by L. Besson; Thundersqualls in Wisconsin, June 9–10, 1922, by W. P. Stewart; and Concussions from Naval Gunfiring Felt at Los Angeles, by R. A. Nelson.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. H. SHEPARD (*Massachusetts Sta. Met. Buls.* 403–404 (1922), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1922, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Soils, irrigation, and drainage investigations (*California Sta. Rpt.* 1921, pp. 19, 20, 21, 22, 23).—A number of studies are reported, among which the progress of the ground-water studies at Kearney Park is set forth briefly.

Field studies by S. H. Beckett and F. J. Veihmeyer are said to show that after an irrigation a uniform soil has a very even distribution of water throughout the wetted portion. Any increase in the quantity of water increases the depth of penetration but not the amount held in any part of the wetted zone. Laboratory experiments by C. F. Shaw, conducted under controlled conditions, using a long column of soil, seemed to bear out this observation, provided the applied water was not greater than the amount required to wet the full depth of soil used. Repeated tests, using different depths of irrigation water, showed that the amount held in any given portion of the soil is relatively uniform, regardless of the amount applied, but that if there is any obstruction to the free downward percolation of the water, the quantity of water increases materially throughout the entire zone above that obstruction.

Field studies by Beckett and Veihmeyer on the efficiency of soil mulches in reducing the loss of water by evaporation from the surface, when the initial amount of water present is not above the normal water-holding capacity,

seemed to show that under such conditions a mulch had a very limited effect in saving water. Repeated laboratory tests by Shaw, R. F. Monroe, and R. E. Storie to determine the losses by evaporation after the application of a limited irrigation showed that with undisturbed soils the upper 3 in. dried out very quickly, but that after this water had been lost by evaporation further losses were very small. The experiments seemed to bear out the field observations that, in irrigated soils under the conditions mentioned, mulches will have little effect in conserving the moisture supply.

Investigations by Shaw on the relative distribution of water lifted into the soil by capillary forces showed that there is a critical moisture point at from 4 to 6 in. above the bottom of the tube, where a larger quantity of water is held than at any other point in the soil column. Comparisons of the distribution of water by capillary rise and by irrigation, using the same amount of water on the same depth and quantity of soil, showed that while the distribution after irrigation is relatively uniform throughout the column, the distribution after capillary rise is less uniform. The quantity increases from the bottom of the tube to a height of from 6 to 8 in., then decreases until the dry soil or the surface of the soil in the tube is reached. Where large quantities of water were used and the soils were free to hold or to lift as much as they could, it was observed that a much larger total amount of water was held in a given depth of soil through capillary rise activities than by the water-holding action after irrigation.

In an experiment to determine the effect of varying quantities of organic matter on the water-holding capacity of the soil as measured by the moisture equivalent, Monroe found that there was a direct relation of considerable moment between the amount of organic matter present and the moisture equivalent. There did not seem to be any marked relation between the latter and the condition of the organic matter, whether in a raw state or in a state of thorough decay. It was further observed that the presence of clay in the soil had a much larger unit influence on the water-holding capacity than did the presence of organic matter.

In studies of the development of an improved soil tube, Viehmeyer found that soil samples taken with a tube give a better measure of the maximum moisture content than samples taken with an auger. A type of soil tube has been evolved which takes a perfect core with no compacting.

Soil survey of Butts and Henry Counties, Ga., D. D. LONG ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 28, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 326,400 acres, comprising two counties, lying within the Piedmont region northwest of the geographical center of Georgia. The topography is in general gently rolling, and drainage is said to be well established. The soils are of residual and alluvial origin. Including meadow, 7 soil types of 3 series are mapped, of which the Cecil sandy clay loam and sandy loam cover 67.5 and 17.9 per cent of the area, respectively.

Soil survey of Lamar County, Miss., E. M. JONES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Mississippi Geological Survey, deals with the soils of an area of 316,800 acres lying in the Coastal Plain province in southern Mississippi. The topography in general is rolling, and the drainage in most places is said to be well established. There are three physiographic divisions, including uplands of residual origin and terraces and first bottoms of alluvial origin. Including swamp, 21 soil types of 11 series are mapped, of which the Ruston fine sandy loam covers 42.5 per cent of the area.

Soil survey of Kershaw County, S. C., W. J. LATIMER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 71, fig 1, map 1*).—This survey deals with the soils of an area of 486,400 acres lying in the Piedmont Plateau, the Coastal Plain, and the river flood plains provinces in north-central South Carolina. The topography varies from level to hilly, and drainage is said to be well established over most of the area.

The soils are of residual, sedimentary, and alluvial origin. Thirty-two soil types of 20 series are mapped, of which the Norfolk sand including a sand-hill phase covers 34 per cent of the area.

The characterization of clay, N. M. COMBER (*Jour. Soc. Chem. Indus., 41 (1922), No. 5, pp. 77T-80T*).—A summary of theories and original studies on the essential differences between clay and all other systems of siliceous mineral matter and on the differences between lean and fat clay are presented in this report.

It is concluded that the constitutional characteristic of clay which distinguishes it from other systems of siliceous particles is that in clay the properties of the emulsoid surface outweigh those of the suspensoid core, while in silt the properties of the core of the particles are not dominated by the relatively smaller amount of emulsoid surface.

A preliminary study on the action of lime on clay yielded further evidence of the colloidal constitution of clay and of the relation of that constitution to the fatness of clay. The suggestion is advanced that the fundamental and general difference between fat and lean clays is the higher proportion of emulsoid surface to suspensoid core in the fat clays.

Recent work on soil acidity and plant distribution, E. T. WHERRY (*Science, n. ser., 55 (1922), No. 1430, pp. 568-570*).—In a contribution from the U. S. Department of Agriculture, the author reviews the results of studies by himself and others in support of his conclusion that soil acidity is of fundamental importance in controlling the distribution of native plants.

The hydrogen-ion concentration of soils as affected by drying, P. S. BURGESS (*Science, n. ser., 55 (1922), No. 1433, pp. 647, 648*).—Studies conducted at the Rhode Island Experiment Station on the effect of drying and heating of soils on their H-ion concentrations are briefly reported.

It was found that drying granitic soils of high potential acidity either at room temperatures or at 103° C. had but little effect on their H-ion concentrations, although there appeared to be a tendency toward slightly increased acidity at the higher temperature in practically every case.

Drying alkaline soils rendered them decidedly less alkaline, especially where a temperature of 103° was used. Drying had practically no effect in the case of a neutral soil.

Alkali investigations (*California Sta. Rpt. 1921, pp. 24-26*).—In studies on the reclamation of alkali land, by W. P. Kelley, it has been found that the application of gypsum resulted in a substantial reduction of the black alkali in the first foot of soil and a small reduction in the second foot. Below this level the gypsum had very little effect. The white alkali salts were largely leached out both on the gypsum-treated and check plats. The results are taken to indicate that it is not practicable to remove black alkali from this soil by leaching alone.

Studies by A. B. Cummins on the formation of black alkali in soils have shown that black alkali may be formed (1) as the result of leaching, where the soil has been previously impregnated with sodium chlorid or sodium sulphate, (2) by the action of sodium chlorid or sodium sulphate on calcium car-

bonate, and (3) by the action of meteoric water on the granites from which the soils have been derived.

Studies of the effects on plants caused by high concentrations of salts and high alkalinity in soils have shown that concentrations of the hydroxyl ion in excess of pH 8.2 to 8.5 are very toxic to many plants. In applying these data to soils it has been found that high pH values of soil suspensions, although grounds for suspicion, do not always imply toxicity for the reason that the alkalinity of the soil solution in certain soil systems may be markedly decreased by the carbon dioxide present. Experiments on the chemical mechanism of injury to plants by salts, alkalinity, and acidity have shown that when equal osmotic concentrations of sodium chlorid, sodium sulphate, and calcium chlorid are considered, the last-named salt is the most toxic to barley. High concentrations of calcium chlorid may produce marked effects on the reaction and buffer system of the plant.

Studies by C. B. Lipman and A. R. Davis on the resistance of wheat to common salt in culture solution have shown that this resistance seems to be extremely high under the conditions of the experiments. Stimulation to the growth of the wheat plant was noted in concentrations up to 6,000 parts per million of common salt in the solution. A temporary depression occurred at the lower concentrations both at the roots and tops at certain stages in the growth of the plant.

Experiments by P. L. Hibbard have shown that a small amount of sodium alkalinity in soils may be so largely neutralized by gypsum that the remaining alkalinity does not seriously hinder production of good crops, but if the original alkalinity is high or if the soil contains a large amount of sodium salts, gypsum alone is ineffective and leaching also is required. Leaching may be done in thin layers 2 in. in thickness or in columns 5 ft. in depth, the latter practice requiring a much longer time for complete leaching than the former. The results of experiments on the neutralizing effect of sulphur seem to offer a means whereby this long period of leaching and subsequent long time for restoration of fertility may be very materially shortened. It was found that rapidly decaying organic matter such as manure or green manure reduces toxic alkalinity in proportion to the rapidity of formation of carbon dioxide.

Peat and muck soils, W. NEWTON (*Brit. Columbia Dept. Agr., Dept. Circ.* 39 (1922), pp. 8, figs. 2).—Brief practical information on the reclamation and management of peat and muck soils in British Columbia is presented.

A method for counting the number of fungi in the soil, S. A. WAKSMAN (*Jour. Bact.*, 7 (1922), No. 3, pp. 339-341).—In a contribution from the New Jersey Experiment Stations, it is pointed out that the ordinary plate method of counting the fungi in soil is so subject to error as to make the results obtained thereby practically valueless.

In studies to devise a more accurate method, use was made of the fact that fungi can grow readily at a much higher acidity than bacteria, and a medium was prepared having a reaction acid enough to prevent the growth of the Actinomycetes and the great majority of bacteria. Experiments with the same soil showed 29,400 fungi per gram of soil by the new method and 460,000 by the plate method.

Microorganisms concerned in the oxidation of sulphur in the soil, I, II (*Jour. Bact.*, 7 (1922), No. 2, pp. 231-256, figs. 3).—Two papers are presented on the subject.

I. Introductory, S. A. Waksman (pp. 231-238).—Studies conducted at the New Jersey Experiment Stations on the physiological and morphological dif-

ferences of the microorganisms concerned in the oxidation of sulphur in the soil are reported.

It was found that the microorganisms concerned in the sulphur cycle may be separated into reducing and oxidizing bacteria, the latter being the true sulphur bacteria and divided into five groups. The first three groups are found in sulphur springs, canal and mud waters, curative muds, river water, and sea water, and they oxidize hydrogen sulphid and sulphids, but not elementary sulphur, and accumulate sulphur within their cells. The fourth group, consisting of small rod-shaped organisms, is found in sea water, canal water, and soil. These bacteria are able to oxidize hydrogen sulphid and other sulphids, thiosulphates, and elementary sulphur, forming a heavy pellicle on the surface of the medium and allowing an accumulation of sulphur outside of their cells. The fifth group of sulphur bacteria occurs in soils to which elementary sulphur has been added, particularly in soil-sulphur composts, oxidizing primarily elementary sulphur, thiosulphates to a small extent, but not hydrogen sulphid or sulphids. These bacteria grow uniformly throughout the medium, not forming any pellicle, do not liberate any sulphur, and allow a very intensive production of sulphuric acid. The necessary carbon is derived entirely from the carbon dioxide of the atmosphere. The fifth group is related morphologically to the fourth group, but includes organisms very small in size and the strongest sulphur-oxidizing and acid-producing bacteria known.

II. *Thiobacillus thiooxidans*, a new sulphur-oxidizing organism isolated from the soil, S. A. Waksman and J. S. Joffe (pp. 239-256, figs. 3).—Studies of the physiology, cultural characteristics, and activities of *T. thiooxidans*, a new sulphur-oxidizing organism isolated from the soil, are reported.

T. thiooxidans n. sp. was isolated from composts of soil, sulphur, and rock phosphate by the use of inorganic media. It oxidized elementary sulphur to sulphuric acid, and derived the necessary carbon from the carbon dioxide of the atmosphere and its nitrogen requirements from inorganic nitrogenous salts. It was responsible for the oxidation of sulphur in the soil and when soil was composted with sulphur or with sulphur and rock phosphate. The sulphuric acid produced from the oxidation of sulphur from *T. thiooxidans* transformed tricalcium phosphate into soluble phosphates and finally into phosphoric acid. This organism produced more acid from the oxidation of sulphur and continued to live in a more acid medium than any other living organism yet reported, the H-ion concentration of the medium increasing to a pH value of 0.6 and less.

Microorganisms concerned in the oxidation of sulphur in the soil.—III, Media used for the isolation of sulphur bacteria from the soil, S. A. WAKSMAN (*Soil Sci.*, 13 (1922), No. 5, pp. 329-336).—In a third contribution to the subject (see above) a comparative review is made of the various microorganisms concerned in the oxidation of sulphur and of those organisms which are or may become active in the soil.

The classification of sulphur bacteria into so-called true and untrue or thiosulphate bacteria, as suggested by Omellanski, is shown to be untenable. If a physiological basis is to be used for the classification of sulphur bacteria, it is thought that they should be grouped as sulphid, thiosulphate, and true sulphur bacteria. Another basis for physiological classification would be that of the optimum reaction for the activity of the organisms, thus grouping them according to optimum activities under acid, alkaline, or neutral conditions. However, division into five groups on the basis of physiological and mor-

phological characteristics is for the present considered to be the most suitable classification.

The composition of various media used for the study of bacteria oxidizing sulphur under acid and alkaline conditions is also given.

Fixation of nitrogen in Colorado soils, W. P. HEADDEN (*Colorado Sta. Bul.* 277 (1922), pp. 48).—This is an extension of previous work of the station (E. S. R., 45, p. 117), and deals with the occurrence of nitrates on rocks. It has been found that nitrates occur universally and often abundantly on the face of rocks. They do not occur in the mass of rocks nor in the waters of deep wells or mines, but are often present in surface waters in large quantities. Their occurrence on the surface of rocks is considered to be analogous to their occurrence in the surface soil. The most favorable kind of rock found for their occurrence is a rather coarse-grained sandstone, the cementing material of which is ferruginous and limy.

These nitrates are considered to owe their formation to biological agents in the sense that the nitrogen contained in them has been gathered from the atmosphere by these agents in their growth. This process is said to be universal, and intense enough to account for perhaps the largest deposits of nitrates. It has been found that the same process is going on under favorable conditions on the stones and bricks in the foundations and walls of buildings, where the maximum quantities of both forms of nitrogen have been found.

In all but one trial out of 60, satisfactory fixation was obtained, the maximum being 297 parts per million. In many instances the amount of nitrification was determined and found to be as great as in soils. The quantities of nitrates on or in the surface portion of rocks are considered to be adequate to account for their concentration in cavities, crevices, and under ledges in rocks, and also in the soil at the base of cliffs in protected places and in some caves.

The base with which the nitric acid is combined will depend upon the character of the rock upon which it has been formed, but subsequent reactions may cause an exchange of the base. The final product has been found to be sodium or potassium nitrate, usually the former.

Experimental research on the manufacture of nitrates by biochemical oxidation of ammonia, E. BOULLANGER (*Ann. Inst. Pasteur*, 36 (1922), No. 4, pp. 305-338, fig. 1).—In a second contribution to the subject (E. S. R., 47, p. 421), experiments conducted on a semi-industrial scale on the biochemical oxidation of ammonium solutions in peat and puzzolan media are described, the purpose being to establish the practicability of the process on a large scale. The plant used is described, and the results of seven experimental runs using peat in different mechanical conditions and puzzolan are reported.

It is concluded that the industrial production of nitrates by this process is both possible and feasible, and that the findings of the laboratory studies were verified in the large-scale experiments. The practical yield of nitric nitrogen was found to be from 87 to 88 per cent of the ammoniacal nitrogen used. Under the conditions of operation followed, the yield was about 50 gm. of nitric nitrogen per cubic meter of medium per day. Puzzolan gave better results than peat, producing a clear solution, while the peat produced a reddish and turbid solution.

A study of the economic features of the process is also included.

Can we afford to make potash in America? R. N. SHREVE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 542-544).—A study is presented of the economic phases of potash manufacture in this country, made with a view to showing the importance of protective tariff legislation for a 5-year period to permit the domestic industry to so develop its processes and by-products and

so cheapen its manufacturing methods that it can compete on a free basis with the world. It is concluded that the only hope of permanently cheap potash in America for both farmers and industries is to establish the domestic industry on a competitive basis. In this connection it is stated that the real way for the farmer to get cheap potash is to buy his own fertilizer constituents and do his own mixing.

The comparative agricultural value of insoluble mineral phosphates of aluminum, iron, and calcium, J. S. MARAIS (*Soil Sci.*, 13 (1922), No. 5, pp. 355-409, figs. 10).—Studies conducted at the University of Illinois to determine the desirability of employing mineral phosphates of aluminum and iron as sources of phosphorus by comparison with calcium phosphate in various forms, both natural and artificial, are reported. Efforts were also made to determine under what conditions these phosphates are of the greatest value for crop growth. The aluminum phosphates were lazulite, wavellite, and Saldanha phosphate. The iron phosphates were dufrenite and vivianite. The sources of calcium phosphate were Florida rock, South African Lalingsburg phosphate, bone meal, and acid phosphate. Disodium hydrogen phosphate replaced the acid phosphate in sand cultures.

It was found that the mineral phosphates of aluminum and iron are valuable sources of phosphorus for plants. Under certain conditions they were superior to calcium phosphates and inferior under others.

The nitrification of urea with the consequent production of acids was found to act very favorably in assisting plants to obtain available phosphorus from all three kinds of phosphates.

Chemically pure phosphates of aluminum and iron were as readily available to the plants tested as pure calcium phosphate. Mineral phosphates of aluminum and iron were not as available as the pure phosphates of the same metals due to the fact that most of them are hydrated basic phosphates. Igniting the minerals, thereby dehydrating the bases associated with the phosphates and destroying the crystalline structure, removed the difficulty of using the mineral phosphates. Aluminum phosphates, whether chemically pure or in mineral form, ignited or unignited, always displayed their maximum effect in a calcareous medium. The effect of iron phosphates was neither enhanced nor depressed by the addition of limestone under the conditions of the experiment.

Where neutral growing media were used, tricalcium phosphates were affected adversely by the addition of limestone. An alkaline soil solution dissolved aluminum phosphate and aided the plant in assimilating nutrient phosphorus. Contact of the roots of plants with mineral phosphates was found to be a very important factor in the assimilation of nutrient phosphorus.

The alkalinity of phosphatic slags, A. DEMOLON (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 24, pp. 680-683).—Studies to determine the solubility of the lime content of a number of different samples of Thomas slag in distilled water, 5 per cent sugar water, 2 per cent carbolic acid, neutral ammonium humate solution, 5 per cent ammonium chlorid solution, and a saturated solution of carbon dioxide are briefly reported.

It was found that only from 1 to 3 per cent of caustic lime exists in slag, and this amount diminishes on exposure to the air. Complex silicates were found which released lime slowly under the action of water, and more readily under the action of sugar water, ammonium humate, or carbolic acid. In the presence of ammoniacal salts or a saturated solution of carbon dioxide, the lime is removed from the slag rapidly at first and then more slowly. Magnesia was found in all samples of slag tested, the average amount being about 8.9 per cent. From 4 to 5 per cent of soluble manganese was also found.

Basic slags as sources of lime, F. E. BEAR and J. L. GAYLE (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 103, 104).—Laboratory studies on the stimulating influence of Thomas slag and duplex basic phosphates on nitrification in an acid soil as compared with ground limestone and calcium phosphate showed that either slag had a value for use on acid soils equivalent to that indicated by its neutralizing power. On this basis, the equivalent in neutralizing value of 1 ton of high-grade limestone can be obtained by the use of approximately 2 tons of either Thomas slag phosphate or duplex basic phosphate.

The effect of limes containing magnesium and calcium upon the chemical composition of the soil and upon plant behavior, W. MATHER (*Soil Sci.*, 13 (1922), No. 5, pp. 337-354).—Field studies conducted at the Rhode Island Experiment Station on the effect of lime materials containing both magnesium and calcium upon the chemical composition of silt loam soil and upon the behavior of different crops are reported.

It was found that during 11 years three applications of hydrated magnesian and calcic limes and ground magnesian and calcic limestones showed little difference in crop yields due to the various forms. Hydrated limes and limestones, high in either calcium or magnesium, acted about the same in the neutralization of soil acidity when applied in equivalent amounts.

Calcic and magnesian limes were found to render the aluminum of the soil relatively insoluble, and magnesian lime applications tended to maintain a ratio of calcium to magnesium in these soils similar to that in unlimed soil. Plants were not influenced by the varying lime-magnesia ratios found, but were sensitive to soil reaction.

Magnesian limestone showed a slight tendency to increase the percentage of total nitrogen in these soils. Hydrated calcic and magnesian limes did not cause any reduction in the percentage of nitrogen, but caused a slight decrease in the percentage of organic matter in the soil.

A study of the influence of the lime-magnesia ratio on soils under continuous cultivation, H. H. HILL (*Virginia Sta. Tech. Bul.* 24 (1922), pp. 3-15, fig. 1).—Studies are reported to determine the relations between lime and magnesia in soils subjected to a one-crop continuous cultivation, using corn as the indicator. The soil used is classified in the Hagerstown series, and consists of loams and clay loams containing cherty material of various sizes.

It was found that the yields on soils which received lime at the rate of 1,200 lbs. per acre were restricted until the soil was rendered alkaline. This was accomplished after this treatment was extended over a period of six years. Applications of lime produced greater yields over a 14-year period than mineral fertilizers. Continuous cropping changed the proportion of lime to magnesia from about 1:1 to a ratio of 1 of lime to 2 of magnesia.

With a 1:1 proportion between lime and magnesia existing, good results were obtained. When the proportion was such that the magnesia was in excess, crop exhaustion was very manifest. Even though lime alone increased the yield during nine years, the yield diminished relatively, indicating that though lime is essential other plant nutrients are necessary to maintain the high producing power of the soils for any extended length of time.

When acid phosphate was applied alone the lime-magnesia ratio was not as wide as on the plots which received mixtures of acid phosphate, potassium sulphate, and sodium nitrate. This narrowing of the ratio between lime and magnesia is thought to be due to the lime in combination with the acid phosphate. Potassium sulphate and sodium nitrate when applied alone exerted no appreciable effect on the retention of lime.

Continuous cropping reduced the yield of corn after five years on all soils except those receiving lime. Soils receiving mineral fertilizers were all diminished in yielding power by continuous cropping. Applications of organic matter in the form of clover and rye without the use of lime failed to restore the soil to its original corn producing power. It is believed that wherever magnesia predominates over lime in soil in a 2:1 proportion, objectionable features will surely follow, with corn as the crop.

A bibliography is appended.

The lime situation in southwestern Michigan, L. C. WHEATING (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 132-134).—A summary of results obtained with the Truog method of determining lime requirement and also by the H-ion-concentration method on typical soils of southwestern Michigan is presented, indicating that without exception the soils need lime. The importance of this need was variable and seemed to show marked differences with relation to the kind of soil. It is stated that from 1 to 3 tons of lime per acre are often needed for profitable crop production in that section of the State.

Recent crop yields from soil experiment fields in Illinois, H. J. SNIDER (*Illinois Sta. Circ.* 260 (1922), pp. 8).—This circular presents the recent results obtained from a number of soil experiment fields located in different parts of the State (*E. S. R.*, 45, p. 727).

Commercial fertilizers, E. G. PROULX ET AL. (*Indiana Sta. Bul.* 262 (1922), pp. 63, figs. 2).—The guarantees and results of analyses of 1,314 samples of fertilizers and fertilizer materials collected for inspection in Indiana during 1921 are presented in this bulletin, together with an account and explanations of all the steps taken to correct violations of the law in the State. The standing maintained by different fertilizer manufacturers, improvements in Indiana fertilizers, elimination of inferior nitrogen, and a brief history of Indiana fertilizer control are also discussed. A comparison of analytical data with the guarantees of the fertilizer manufacturers indicated that of the 1,314 samples, 754 were equal to or above the guaranty in every particular, 1,070 were equal to or above the guaranty in value, and 227 were less than 10 per cent below and 17 more than 10 per cent below the value of the guaranty.

AGRICULTURAL BOTANY.

Studies in plant nutrition (*California Sta. Rpt.* 1921, pp. 30, 31, 32).—Experiments by J. S. Burd and J. C. Martin have shown that reinforcing a fertile soil with either nitrogen, potassium, or phosphorus does not necessarily increase the crop, but it has a marked influence on the absorption of a given element as well as a diminishing effect on the absorption of others. The application of phosphorus is said to reduce potassium absorption, and nitrogen increases it.

D. R. Houghland found, from studies with barley in sand and solution cultures, that within broad limits no definite or specific ratio of nutrient elements is necessary for optimum growth.

W. H. Dore has begun a series of studies on the carbohydrate metabolism of plants, especially hydrolysis of cellulose, to determine the raw materials for cellulose synthesis. In the case of normal cotton cellulose, evidence is said to point to its breaking down through a series of dextrans and a biose sugar to dextrose.

W. F. Gericke, from pot cultures, found that soft spring wheat and oats could be influenced in their protein content and quality by the application of nitrogen to cultures at various stages of growth. The highest protein content and highest quality in wheat was secured when nitrogen was added

110 days after planting, and the lowest content was secured when application was made at the time of planting. He also found that different stages in the development of barley plants could be influenced by the time phosphorus was added to the cultures.

Nutrient requirement of the potato plant grown in sand cultures treated with "type I" solutions, E. S. JOHNSTON (*Soil Sci.*, 10 (1920), No. 5, pp. 389-409, figs. 6).—Having found, in preliminary studies on the fundamentals of nutrition in the potato, that while fairly uniform sprouts could be obtained for water and sand culture growths from tubers planted in sawdust these sprouts did not grow well in water cultures, the author tried, as a culture medium in the tests herein reported, pure white quartz sand treated with the nutrient solutions here considered. Two sets of experiments were undertaken to determine the proportion of salts necessary to produce the best growth of potato plants and the greatest yield of tubers. Irish Cobbler was the variety of potato used throughout these experiments. The procedure and the method of experimentation are presented in detail with discussion.

Potato plants of corresponding cultures of the two series show great similarity in their reaction to the same salt proportions of the 21 different treatments. In spite of the minor differences which appear between the two series, the results can be averaged and general conclusions deduced therefrom.

When the green weight is used as a criterion, the greatest growth is found in cultures high in calcium nitrate, low in magnesium sulphate, and with a medium amount of potassium phosphate. As regards dry weight, it appears that in general there is little difference between the relative numbers of green and dry weight for plants of corresponding cultures.

Whether the green weight of plants (tops and roots together) or the green weight of new tubers produced is used as the criterion of growth, the best average values of corresponding cultures of the two series occurred for the cultures high in calcium nitrate and low in magnesium sulphate with a medium amount of potassium phosphate. Cultures giving the lowest yields were low in calcium nitrate.

The average water requirement for plants of the two series was 403. There was a marked tendency for individual cultures not to vary greatly from this value. There was apparently no relation between high yield and low water requirement and low yield and high water requirement.

The physiological effects of certain salts upon walnut and citrus trees (*California Stu. Rpt* 1921, p. 82).—As a result of nutrition experiments, A. R. C. Haas and H. S. Reed found that the lack of calcium salts is accompanied by the presence of many small dead spots in citrus leaves, followed by an early abscission of the leaves. The leaves produced were small and lacked the usual amount of chlorophyll. In the presence of sodium bicarbonate typical chlorosis of orange leaves developed.

The application of saline irrigation water to soil resulted in the production of "little leaf" in walnut trees similar to that observed in the field.

A theory of injury and recovery, II, III, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 3 (1921), Nos. 4, pp. 415-429, figs. 8; 5, pp. 611-622, figs. 5).—Continuing the series previously noted (E. S. R., 46, p. 128), the first of these contributions deals with experiments made employing mixtures and the second with repeated exposures to toxic solutions.

The electrical conductivity of *Laminaria* changes when the plant is transferred from sea water to 0.52 M NaCl, or to 0.278 M CaCl₂, and is subsequently replaced in sea water. It has been found that these changes can be predicted with considerable accuracy by means of certain equations. According to the

theory of the author, the same equations should enable one to predict the changes produced by transferring tissue from sea water to mixtures of NaCl and CaCl₂, and then replacing the plant in sea water. In order to test this theory experiments were made with a variety of mixtures, the solutions employed being given in tabular form. The equations which serve to predict the injury of tissue and its subsequent recovery also serve as a basis for predicting the behavior of tissue in mixtures of these solutions, as well as its recovery in sea water after exposure to mixtures.

A quantitative theory is developed in order to explain the toxicity of NaCl and CaCl₂, the antagonism between these substances, and the fact that recovery (in sea water) may be partial or complete, depending on the length of exposure to the toxic solution. The experiments and calculations were carried out as previously described, involving exposures in different orders with repetitions to NaCl, CaCl₂, and sea water. It was found that tissues of *Laminaria* transferred from sea water to solutions of pure salts, and to other solutions of pure salts or to sea water, behave in a manner which can be predicted by means of the equations previously developed. This behavior of the tissue may be explained as due to a series of catenary reactions, and it is thought possible that a similar explanation may be applied to other fundamental life processes.

Acceleration of germination under the influence of acids, K. WIENTJES (*Rec. Trav. Bot. Néerland.* 17 (1920), No. 1-2, pp. 33-68).—The accelerating influence of acids on germination does not appear in *Phacelia tanacetifolia*. The outbreak of the radicle which appears without the action of acids is probably a mechanical phenomenon. The same appears to be true in case of *Alisma plantago*. These observations confirm those of Crocker (E. S. R., 19, p. 726) relative to the rôle of the testa. In *Solanum lycopersicum* the acceleration of germination due to acids is apparent. The radicles appear, but they are killed when they come in contact with strong acids. No accelerating action due to acids was observed in case of *Epilobium hirsutum* and of *Lythrum salicaria*.

Nitrogen fixation by cowpeas and nodule bacteria, A. L. WHITING and W. R. SCHOONOVER (*Soil Sci.*, 10 (1920), No. 6, pp. 411-420).—This work was planned in order to carry out a study on the fixation of nitrogen, if possible, at an earlier period than its appearance in cowpeas (14 days after planting) in the investigation previously reported (E. S. R., 33, p. 426).

As a result of the study which is given in detail (involving 1,056 nitrogen determinations, 510 of which were made on the inoculated seedlings, 294 on uninoculated seedlings, and 252 on the seeds), it is stated that nitrogen appeared in inoculated cowpeas growing in purified nitrogen-free sand 9 days after planting. A positive fixation was noted at 11 and 12 days, increasing more notably at 13 and 14 days. The progress of nitrogen fixation bears a direct relation to the development of the plant, a rapid increase occurring soon after the third (first real) leaf is developed, this being 19 days after planting in 3 different experiments conducted during the natural growing period of the plant. In 26 days after planting the nitrogen fixed was three times that contained in the seeds planted.

Preliminary studies of the mechanism of nitrogen fixation did not indicate that oxidation or reduction was concerned in the process.

The morphological constitution [of plant protoplasm], A. GUILLIERMOND (*Rev. Gén. Sci.*, 32 (1921), No. 5, pp. 133-140, figs. 4).—Recent studies are outlined as carried on by others, as well as by the author, leading to the main general conclusion that the structure of plant cells is essentially similar to that of animal cells.

Transpiration studies (*California Sta. Rpt. 1921, pp. 52, 53*).—A. H. Hendrickson has found from studies of prune, pear, peach, and apricot trees that the influence of irrigation, as shown by the transpiration of leaves, does not extend more than three days after water is applied. On bearing trees the rate of transpiration, regardless of the amount of water in the soil, was found to increase daily up to about 11 a. m., after which it steadily decreased.

The water requirement of prune trees in tanks was studied by F. J. Veihmeyer, and he found at the end of the season that all trees had made the same growth and maintained the same vigor whether irrigated four times or three times during the season.

A description is given of a form of apparatus devised by Veihmeyer by which a continuous record of very small losses by transpiration can be made.

Seasonal variations in the water deficit of woody shoots (*California Sta. Rpt. 1921, p. 82*).—H. S. Reed has determined the water deficit in shoots of lemon and apricot trees at frequent intervals during the growing season. The ratio of water in lemon shoots to water deficit was found to range from 2.65 to 9.42, and the ratio of dry matter to water deficit from 0.85 to 4.14. In apricot shoots the ratio of water deficit ranged from 2.32 to 11.49, and that of dry matter to water deficit from 0.77 to 1.88. The ratio of dry matter to water deficit is said to have shown a well marked constancy through the season.

A preliminary account of some investigations on leaf aeration in certain Natal plants, G. W. GALE (*So. African Jour. Sci., 78 (1921), No. 1-2, pp. 153-155*).—In 1920 the author commenced work on the aeration systems of leaves with the object of comparing, in this respect, ecological types of the Natal flora. A brief description is given of the method employed and of certain necessary precautions.

Among the results from the work already done, a criticism is offered of certain conclusions reached by previous authors. Evidence has been obtained that a well developed intercellular space system is not necessarily a mesophytic character, nor a poorly developed one necessarily a xerophytic character.

Careful experimentation indicates that the supposed difference between sun and shade leaves (of the same species) is really due to an increase in the specific gravity of the leaf substance of sun leaves as compared with that of shade leaves.

From the ecological standpoint the degree of variation exhibited by various types has furnished some data. The quantitative results indicated are considered valuable in that they illustrate and confirm an important ecological principle which is credited to Bews. This principle is that pioneer types are more variable in their physiological structure and functions than are subsequent types, and for that reason are able to adapt themselves to the more varied and more variable conditions presented by the habitat during early stages in plant succession. Subsequent and climax types, however, are less variable in physiological structure and functions, and for that reason are limited to the stable and often specialized environmental conditions which obtain in the late and final stages of succession.

The work is said to be the first attempt at obtaining precise quantitative confirmation of Bews' suggestive hypothesis. The results obtained indicate that further work along similar lines (the comparison of the physiology and physiological structure of pioneer species with that of subsequent species in various plant successions) may be expected to provide results of equal importance in either confirming or modifying the original hypothesis.

Drought periods and climatic cycles, F. E. CLEMENTS (*Ecology, 2 (1921), No. 3, pp. 181-188*).—A review is given of data contained in contributions bear-

ing upon the relations supposed to exist between rainfall, particularly in the west, and the sun-spot cycle. The importance to agriculture, grazing, and forestry of being able to anticipate periods of serious drought has been discussed in some detail in contributions previously noted (E. S. R., 45, p. 525). It is conceded that the extent to which the sun-spot cycle can be utilized in predicting periods of drought or rainfall can be determined only by actual trial, and that the success attending the first attempt to do this may have been purely accidental. However, the results of studies indicated by authors named on the growth rings of trees and the grand totals of the table shown in the present article are thought to indicate clearly the basic importance of the sun-spot cycle for long-range weather prediction.

Genetics (*California Sta. Rpt. 1921, pp. 91, 92*).—E. B. Babcock and J. L. Collins report the extension of their work with *Crepis* spp. and tarweeds (*Hemizonia luzulaefolia*). In *C. capillaris* crosses have been made between several rosette types and types of normal growth habit, which are being studied for their mode of inheritance. Flower size and inheritance of other pairs of characters are also being investigated. In *C. tectorum* flower color differences and differences in size of plant furnish the principal material for the present hereditary studies.

In the genetic study of the tarweeds, Babcock found the yellow, spring-flowering group and the white, fall-flowering group to be genetically different, and they are considered worthy of being ranked as distinct species. The yellow, spring-flowering group contains a diversity of biotypes, some of which have been isolated by means of inbreeding. The inbred strains showed strikingly the harmful effects of inbreeding in a wild, naturally cross-fertilized species. During the period that these wild plants have been under observation a number of abnormal types have been discovered which are considered to represent recessive characters that are seldom displayed by wild plants because of their cross-fertilization.

A dwarf mutation in *Portulaca* showing vegetative reversions, A. F. BLAKESLEE (*Genetics*, 5 (1920), No. 4, pp. 419-433, fig. 1).—A dwarf mutation of *P. grandiflora*, first noted in 1914 and characterized by short internodes, is described and figured.

The dwarf habit of growth is inherited as a simple Mendelian character recessive to the dominant normal habit. About 125 per cent of the recessive dwarf plants produce reverting branches with the dominant normal habit of growth. Occasional normals found in offspring of selfed dwarfs are probably due to reversions bringing about normal gametes or to reversions in the early development of the zygote. Dwarf branches from reverting plants when selfed breed as true as typical dwarfs. Reverting branches from otherwise dwarf plants are heterozygous, and 3:1 ratios when selfed and 1:1 ratios when back-crossed to dwarfs. The reverting branches produced by dwarfs are classed as dominant vegetative mutations.

FIELD CROPS.

Relation of crop yields to quantity of irrigation water in southwestern Kansas, G. S. KNAPP (*Kansas Sta. Bul. 228 (1922), pp. 3-29, figs. 11*).—Experiments to determine the yields produced by different quantities of water applied to milo, kafir, sumac sorgho, Sudan grass, wheat, oats, and barley were carried on at the Garden City Substation in cooperation with the U. S. Department of Agriculture (E. S. R., 46, p. 434).

The data led to the conclusion that the amount of water required to maintain a given percentage of soil moisture varies somewhat with the kind of crops

grown. Crops differ greatly in the quantity of water which they can use profitably and in the range of yield brought about by applying different amounts of water.

Milo showed a marked ability to increase its grain yield as additional water was applied. Milo receiving sufficient irrigation water was affected less by unfavorable climatic conditions than were the other crops studied. Increasing the amount of water did not affect the stover yield greatly. Kafir exhibited similar characteristics, but so far as indicated by grain yield was unable to respond to the application of water to the same extent as milo. Sumac sorgo could not use large amounts of water economically, and its stover yield declined when more than about 15 in. was applied. Sudan grass failed to respond uniformly and significantly to increased quantities of water, either in yield of seed or stover, and more water was used for Sudan grass than for any other sorghum crop in the experiment. Sudan grass in rows for seed is not considered a profitable irrigation crop, and if so grown should not be irrigated heavily. The yields of small grain crops such as wheat, oats, and barley are evidently controlled to a greater extent by prevailing climatic conditions than by available amounts of water, and no quantity of water has sufficed to insure good yields in unfavorable years.

Grass and forage plant investigations (*California Sta. Rpt. 1921, pp. 45-48*).—Range studies and observations by P. B. Kennedy in cooperation with the Forest Service, U. S. D. A., led to conclusions that burning over the foothill lands was largely responsible for a dense growth of such annual weedy species of grasses as *Bromus villosus*, *B. hordeaceus*, and *Festuca myurus*, possessing low forage value and only reliable for early spring feed. Dry periods favor the increase of introduced weedy annual grasses which tend to crowd out more valuable native perennial species. The many excellent meadows in the middle or forest zone need only protection from overgrazing for recuperation and abundant production of forage. The rugged and rocky character of the very extensive upper or alpine zone render it chiefly valuable as a sheep range, but where accessible the plants are for the most part palatable and nutritious. By judicious methods of salting, stock may be so located as to relieve areas that are being overgrazed. A forage plant that will thrive underneath the fir and pine associations is needed to increase the carrying capacity of the middle ranges. The chief losses among cattle from poisonous plants were due to the tall larkspur (*Delphinium decorum patens*), and among sheep to white laurel (*Rhododendron occidentale*).

Experiments by Kennedy prove the feasibility of establishing coast pastures of perennial grasses and forage plants without irrigation, by broadcasting 10 lbs. each of English rye grass and rescue grass, and 5 lbs. each of Smilo grass (*Oryzopsis miliacea*), Harding grass (*Phalaris stenoptera*), and burnet about November on a well-prepared seed bed, cutting for hay the next spring, and not pasturing until fall. Stock should be removed during the rainy season until a firm sod is established.

Notes are included on Smilo grass, Napier grass, Harding grass, rescue grass, burnet, purple vetch, and sheep tansy.

[Work at the California Station with] field crops (*California Sta. Rpt. 1921, pp. 31, 32-36, 37, 38, 39-41*).—A continuation of previous work (E. S. R., 44, p. 731) is reported.

Tennessee Winter, Four Thousand, and Marlout (E. S. R., 42, p. 32) barleys are spoken of as popular new varieties rapidly replacing common barley in the areas where better adapted. A census of Marlout barley growers in 1920 by G. W. Hendry showed Marlout preferred to Coast barley, and with a pro-

duction of one-third more grain per acre. J. W. Gilmore and J. A. Denny report that Mariout produced 9.4 per cent more grain than Coast barley at Kearney Park, but that Coast produced 60 per cent more hay. The combined harvester, which requires grain to be dead ripe before cutting, and north winds occurring at this stage are held responsible for the extraordinarily heavy barley-shattering loss in the State. A typical north wind, May 30 to June 1, 1919, produced estimated losses of 10.8 bu. per acre with Mariout, 33.2 bu. with Coast, and 33.8 bu. with Four Thousand at University Farm. While Idaho, Primus, and Argentine exhibited the greatest shattering resistance, no variation from ordinary varieties was found in the ash content of the rachises.

University Farm dwarf milo, developed by B. A. Madson and Hendry, proved more uniform than other strains tested, stooling less and carrying more of its heads in an erect position. Yolo maize, a new grain sorghum, has been described elsewhere (E. S. R., 46, p. 835).

W. W. Mackie and Brown found that continuous flooding to a depth of 8 in. or more destroyed water grass (*Echinochloa crus-galli*) without injuring rice, which, on the contrary, produced better growth in the greater depths.

Common, hairy Peruvian, and smooth Peruvian alfalfa grown at Kearney Park by P. B. Kennedy and Denny produced in 1920 in six cuttings 9.94, 10.2, and 9.78 lbs. per acre, respectively. S. H. Beckett observed that larger yields of alfalfa were obtained with a greater number of light irrigations rather than with fewer heavy irrigations, but that under conditions at Davis increased yields due to frequent light irrigations were not sufficient in value to cover more than the increased labor.

In continued studies upon the yield and feeding values of cereals as hay crops, Hendry and F. W. Woll cut Pacific Bluestem wheat, Coast barley, Black oats, and Abruzzi rye in the soft dough stage, and recorded yields of 4.17, 4.86, 3.74, and 3.79 tons per acre, respectively. A physical analysis of the hays revealed that the rye consisted of from 12 to 19 per cent more culm than the other hays, that the oats had from 10 to 16 per cent more leaves, and that barley consisted of from 10 to 18 per cent more heads than the other hays. Oats showed the lowest percentage of culm, barley the least leaves, and rye the smallest percentage of heads, while wheat held an intermediate place.

According to Gilmore and Denny, working at Kearney Park, the yield obtained with sweet sorghum for forage is almost in direct proportion to the length of the growing season. Sumac averaged 41.1 tons per acre for three seasons, while Early Amber returned only 17.2 tons.

Danish Sludstrup mangels with 55.2 tons, Purple Top rutabagas with 18.2 tons, White Intermediate carrots with 7.8 tons, and Purple Top White Globe turnips with 30 tons per acre were outstanding in variety trials with root crops by Hendry. Stored in sand in a shallow cellar, mangels remained longest in a fresh succulent condition, rutabagas next, carrots next, and turnips the shortest. White carrot varieties kept better than yellow or orange-fleshed varieties. Leaf-eating insects inflicted the greatest damage on rutabagas and turnips, and the least on mangels and carrots.

Blue Blossom Dutch fiber flax, pulled green by Hendry, yielded only 283 lbs. of light seed per acre, while flax cut when seed was ripe produced 559 lbs. of seed. The pulled flax yielded 300 lbs. of fiber per acre and the cut portion 244 lbs.

A selection of Mebane with 227 lbs. of seed cotton per acre led the cotton varieties tested by Hendry at Davis.

As much as 3,124 lbs. of unhulled seed per acre was produced by a castor bean variety tested by Madson and Hendry. Chinese vegetable tallow (*Stil-*

lingia sebifera), with an oil content of 33.6 per cent, gave promise of commercial value.

[**Report of field crops work in St. Vincent, 1920**], F. WATTS (*West Indies Imp. Dept. Agr., St. Vincent Agr. Dept. Rpt. 1920, pp. 4-11, 11, 12, 14-21*).—Investigations and industrial developments with field crops during 1920 are described in continuation of similar work (E. S. R., 46, p. 226).

In the manurial experiments with Sea Island cotton (E. S. R., 46, p. 31) from 1912 to 1920, inclusive, where the average acre yield of seed cotton from the untreated plats amounted to 563 lbs., that fertilized with nitrogen averaged 676, with phosphate 668, with potash 813, with phosphate and potash 713, with nitrogen, phosphate, and potash 749, with cottonseed meal 661, and with cottonseed meal, phosphate, and potash 825 lbs.

[**Colseess barley**], A. KEZER (*Colorado Sta. Rpt. 1921, p. 11*).—Colseess barley, a cross between Coast and Success, is described as beardless, with relatively high yields and stiff straw, and with indications of value as a high-altitude barley. It ranked among the first ten barley varieties in yield at the station, and was first at Fort Lewis in 1921.

Varieties of corn and their adaptability to different soils, C. A. MOORE (*Tennessee Sta. Bul. 126 (1922), pp. 3-39, figs. 15*).—Variety trials with corn were conducted for considerable periods with many strains and under varied soil and climatic conditions throughout the State. Varieties are grouped according to length of season and number of ears per stalk; stalk and ear heights and shelling percentages are tabulated; and the sources and important qualities of each variety are indicated. Part of this work has been reported elsewhere (E. S. R., 46, p. 829).

In spite of the wide range of soil conditions and physical types, changes in altitude from 400 to 2,000 feet, and differences in longitude up to 350 miles, certain varieties, including Neal Paymaster, Albemarle, Piedmont White Dent, Jarvis Golden Prolific, and Biggs Seven Ear, were prominent as high yielders throughout the tests. Comparisons of grain yield data, assembled on the basis of Hickory King yields under different conditions of soil productivity and expressed graphically, indicated that a variety may be inferior on poor land, but of merit on rich land, viz. Albemarle Prolific; do especially well under poor- or medium-land conditions, but not on rich land, as indicated for Piedmont White Dent; like Neal Paymaster, be of high merit on all kinds of soil; and as Leaming, prove inferior to the leaders under all conditions.

Cotton variety test, 1921, R. R. CHILDS (*Ga. Agr. Col. Bul., Jan., 1922, pp. [4]*).—Varieties outstanding in the 1921 test with good yields at all pickings included College No. 1, strains of Cleveland, Poulnot, White Improved, Cook Improved, Culpepper, and Texas Bur. These are indicated as medium early maturing, continuous fruiting varieties. Petty Toole, with 1,875 lbs. of seed cotton, produced the highest total yield, but is not so early as some other varieties. Half-and-Half and Dixie produced good yields, but the lint of the former and the lateness of the latter make these types of doubtful value. Foster made the largest yield among the long staple upland varieties, while Meade gave the highest value per acre.

Cotton experiments, 1921, H. B. BROWN and J. F. O'KELLY (*Mississippi Sta. Bul. 205 (1921), pp. 4-11, 14, 15*).—Results are reported from various experiments with cotton (E. S. R., 45, p. 130) carried on in 1921.

Piedmont Cleveland produced the most seed cotton, 1,614 lbs. per acre, and Deltatype Webber, Express 350-718, and Delfos 6102 were leaders in money value. Half-and-Half, with a lint percentage of 44, produced more lint per acre than any other variety, but the staple was considered unsalable by classers.

Lone Star selections, Triumph, and Delfos ranked highest in money value on hill land, but the length, strength, and character of the staple was inferior to that of the same varieties in other tests. Mississippi Station Trice, Delfos 6102, and certain strains of Express produced much higher percentages of their blossoms during the early part of the blooming period than did other varieties, suggesting a decided advantage for regions of heavy boll weevil infestation. The most prolific blooming strains were generally high yielders. Calcium cyanamid and sodium nitrate made the highest net gains in tests of nitrogenous fertilizers for cotton.

Brazilian cotton, A. S. PEARSE (*Manchester, Eng.: Internat. Fed. Master Cotton Spinners' and Manfrs.' Assocs., 1921, pp. 231, pls. 3, figs. 74*).—This is the report of the expedition of the International Cotton Mission through the cotton States of Brazil, comprising Sao Paulo, Minas Geraes, Bahia, Alagoas, Sergipe, Pernambuco, Parahiba, and Rio Grande do Norte. In addition to a concise discussion of the geography and history of Brazil and of cotton manufacture, with general remarks on cotton and other chief export commodities of Brazil, detailed accounts are given of the cotton industry in the States named. A list of cotton mills in Brazil in 1919 is appended.

Potato studies (*California Sta. Rpt. 1921, pp. 86, 87, 88*).—White Rose, Idaho Netted Gem, and Russet Burbank potatoes harvested in June, 1920, and stored until February 1, 1921, in a room kept constantly at 36° F., produced 95 per cent stands when planted in March. Studies by D. H. Carey indicated that tubers of the spring crop intended for seed the same year do not need piling with straw covering immediately after digging, and daily sprinkling. Wisconsin Pride with 14,491 lbs. per acre and American Wonder with 7,633 lbs. led the varieties tested. An abnormal growth of white underground stems, accompanied by a material decrease in yield was exhibited by many plants, when half-matured, of the Duchess of Seedlings, Pride of Multnomah, Beauty of Hebron, Gold Coin, Burbank, Sir Walter Raleigh, British Queen, and American Wonder varieties in the spring crop at University Farm. This condition was not present with Rural New Yorker, Russet Burbank, Idaho Netted Gem, and Wisconsin Pride growing in the same field.

Report of the work of the Rhenish Potato Research Institution in 1920 and 1921, T. REMY (*Veröffentl. Landw. Kammer Rheinprov., No. 1 (1922), pp. 72*).—The progress of experiments with potatoes conducted in the Rhine Province in 1920 and 1921, and including variety, cultural, fertilizer, and rotation trials, and tests of seed stock, is described in continuation of previous work (*E. S. R., 45, p. 535*).

The influence of size and character of seed on the yield of potatoes, R. N. SALAMAN (*Jour. Agr. Sci. [England], 12 (1922), No. 2, pp. 182-196, figs. 4*).—Further experiments gave results closely coinciding with those recorded earlier (*E. S. R., 45, p. 635*).

Bordeaux used with profit on potatoes, G. E. CULVER (*Michigan Sta. Quart. Bul., 4 (1922), No. 4, pp. 134, 135*).—Potato yields in three counties in Michigan on farms employing power sprayers averaged 207 bu. per acre, on farms using knapsack sprayers 146 bu., and unsprayed 112 bu. Applications of Bordeaux with a power sprayer cost \$3.59 per acre, while applications with knapsack sprayers cost 59 cts. per acre.

Improvement of sorghums by hybridization, H. B. VINALL and A. B. CROON (*Jour. Heredity, 12 (1921), No. 10, pp. 435-443, figs. 7*).—The progress and methods of the Office of Forage-Crop Investigations, U. S. D. A., in improving sorghums by hybridization are described, with notes on the manner of inheritance of several minor characters.

The uniformly red-brown seed color of Red Amber sorgo is dominant over the bluish-white seed color of feterita, and the F_2 segregation indicates that apparently two independent unit factors are involved in the determination of seed color. In crosses between feterita and kafir, two factors also seemed to be concerned in the production of color, but they were not the same that determined color in the Red Amber sorgo seed.

Where Red Amber sorgo was used as the pistillate parent in several crosses, it was found that the red in its glumes was dominant over the black in glumes of feterita, and the results indicated only a single factor difference between red and black glumes. In crosses between dwarf milo, with awned glumes, and feterita, without awns, the awn was found to be a recessive character, and the broad truncated shape of the milo glumes was shown to be dominant over the narrower ovate shape of the feterita glumes.

Growing soy beans in corn, J. B. PARK, C. J. WILLARD, and H. L. BORST (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 75-78).—Three years' experiments in growing corn and soy beans, alone and in combination, at the Ohio State University, suggest drilling together in the same row at the same time by a special attachment on the planter, or by double drilling. The poorer the soil is in organic matter and nitrogen, the more likely will the combination out-yield corn alone. Unfavorable soil or adverse season results in a higher proportion of soy beans in the combination than with favorable conditions. Early planting with corn not thicker than the normal rate for grain on the land is recommended with the beans 4 to 6 in. apart in the row, and, if for silage, preferably an erect, tall-growing variety of soy beans such as Peking, Virginia, or Wilson.

Corn and soy beans for silage, L. E. THATCHER (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 79-81).—Results obtained at Wooster agree in general with those noted above. Addition of soy beans in the same hills with corn slightly reduced the total yield of silage as compared with corn alone. Clarage corn, a standard grain variety, and soy beans made the largest total yield by drilling, and the smallest by checking. Clarage alone in hills averaging 4 plants each, yielded a little more than when drilled with soy beans. Blue Ridge corn, a late maturing silage variety, and soy beans yielded practically the same with drilling or checking, and slightly less than corn alone in hills. The growth of soy beans was smaller in competition with Blue Ridge than with Clarage corn. Soy beans planted at the same time as corn yielded three times as much as when planted two weeks later. Even when planted at the same time, the average proportion of soy beans to corn only approximated 1:13 by weight. Soy beans planted half way between the corn hills did a little better than when planted in the corn hills.

When grown with soy beans in the same hill, the average weight of Blue Ridge corn and of sunflowers decreased as the stands of plants increased. The average size of the soy-bean plants decreased markedly as the stand of corn or sunflowers increased. In such combinations the yield of the soy beans is probably determined by the amount of competition with the companion crop.

The experiments of [O.] Munerati with sugar beets, J. DE VILMORIN (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 9, pp. 312-317).—Summaries are given of a series of brochures by Munerati on his experiments at the station for beet culture at Rovigo, Italy.

Studies of the influence of soil and fertilizers on the production of seed in the first year of growth showed 2 per cent of beets to produce seed in sandy soil, 11 to 15 per cent in clay soil, and 28 to 34 per cent in peaty soil. Organic fertilizers with or without minerals increased the percentage considerably.

Plants with little vigor produced seed equally with the vigorous. Observations on the behavior of the progeny of beets producing seed the first year indicated that bearing seed the first year does not necessarily constitute a return to the ancestral form. Although equilibrium is found in annularity in the wild type and in the biennial habit in the cultivated type, races of annual or biennial character may be obtained easily in both cases. The early seed plat and cessation of growth increases the proportion producing seed the first year, but when the equilibrium of a race turns to annuality these conditions are held unnecessary for obtaining numerous seed producers.

A beet can attain its maximum sugar content long before or after its neighbor, and, therefore, two beets of present identical richness can have progeny with different sugar content.

Notes are also given on the preservation of the vitality of seed, anomalies in the beet, and observations on *Beta maritima*.

Sugar cane varieties of Porto Rico, II, F. S. EARLE (*Jour. Dept. Agr. Porto Rico*, 5 (1921), No. 3, pp. 141).—Additional data are presented concerning varieties mentioned previously (E. S. R., 41, p. 830) and several other varieties. The history of cane varieties in Porto Rico is outlined briefly, and consideration is given to the deterioration of varieties and the possibility of improving existing varieties through bud selection. The author discusses flowering, ripening, and deterioration of sugar cane, long ratooning, and the botany of sugar cane varieties. The sugar cane soils of Porto Rico are treated in some detail, and varieties of sugar cane are indicated for special purposes and conditions. A revised key to the varieties described is also included.

The sugar industry and its by-products, P. DE LA TORRE (*Cuba Sec. Hacienda, Secc. Estadis, Indus. Azucarera Zafra 1920-21*, pp. 123, pls. 5).—Statistics similar to those noted previously (E. S. R., 46, p. 535) are tabulated, special consideration being given the campaign of 1920-21.

Utilization of flue-heated tobacco barns for sweet potato storage, F. E. MILLER (*U. S. Dept. Agr., Farmers' Bul. 1267* (1922), pp. 1-3, 9-12, figs. 3).—In tobacco sections in sweet potato territory where flue curing is practiced, many tobacco barns have the equipment necessary for providing the heat for curing sweet potatoes at harvest time, and need only slight modification to become satisfactory sweet potato curing and storage houses. The modifications need not interfere with their use as tobacco curing barns, as the curing of the tobacco is over before the harvesting of sweet potatoes. Directions are given, as noted on page 688, for remodeling these structures for the dual purpose, with instructions on harvesting and curing and descriptions of seven leading varieties of sweet potatoes.

Sweet potatoes stored in bins in modified tobacco barns at the South Carolina Pee Dee Substation from November 10, 1919, to March 25, 1920, suffered 11.2 per cent of shrinkage and 4.75 per cent of decay. In crates from November 7 to March 24, the percentage of shrinkage was 7 and the decay 1.7.

Genetic investigations in tobacco (*California Sta. Rpt. 1921*, pp. 92, 93).—W. A. Setchell, T. H. Goodspeed, and R. E. Clausen demonstrated the existence of two flower colors about identical in appearance in *Nicotiana tabacum*, carmine dominant to light pink, and red, recessive. The dominant carmine flower color was found in *N. tabacum purpurea*. Derivative lines secured by back-crossing *F₁ sylvestris-tabacum* hybrids to their *tabacum* parent, while apparently constant and identical with their *tabacum* parent, were found to exhibit concealed hybridism.

The large flower size form of *tabacum*, studied for six generations, was found always to segregate discontinuously for a smaller flower size. The

fact that the large-sized form never breeds true, and the nature of the segregation ratios, indicate that it is probably a case of nondisjunction inherited through only one of the series of gametes, presumably the ovules. In one bud variant observed in *tabacum* hybrids, half the plant bore light pink flowers, a variation from the carmine exhibited by the rest of the plant; and in another variant a small branch in the inflorescence of a pink-flowering plant produced white flowers. These bud variants are both considered periclinal chimeras.

The effect of available nitrogen on the protein content and yield of wheat. R. E. NEIDIG and R. S. SNYDER (*Idaho Sta. Research Bul. 1* (1922), pp. 3-56, figs. 14).—Marquis wheat was grown in the greenhouse on soils and soil-sand mixtures containing different percentages of available nitrogen; on soil to which available nitrogen was added in the form of sodium nitrate, ammonium sulphate, and hydrolyzed wheat extract; and on soil receiving casein and keratin as sources of nitrogen. The soils employed were a highly fertile and a depleted Palouse silt loam. Increases both in yield and in protein content were obtained by the addition of these forms of nitrogen. Marquis wheat grown in the field on the more fertile soil was lower in content of protein but yielded over twice as much grain and straw as Marquis on the poorer soil.

Palouse Bluestem wheat receiving much smaller amounts of the same forms of available nitrogen did not show the same increase in protein content exhibited in the Marquis wheat series. However, the yield was increased in practically every case. Soils receiving nitrogen in the form of casein and keratin produced wheats with yields and protein contents greater than those grown on soils receiving other forms of available nitrogen.

Cumulative additions of sodium nitrate throughout the growing period gave protein contents and yields in all soil-sand mixtures in excess of those obtained when all the sodium nitrate was applied at planting time. Sodium nitrate was added to different cylinders of Palouse Bluestem placed in each soil plat, at the time of planting and in cumulative amounts throughout the period of plant growth. When available nitrogen sufficient to insure a maximum plant growth during the early period was present in the soil a high yield was obtained, and when the nitrogen was adequate for an available supply during the entire life cycle of the plant both high yield and high protein content were secured.

"Under field conditions available nitrogen will show its greatest effect on protein content and yield when climatic factors are most favorable . . . Given an ample supply of available nitrogen in the soil, it is believed that moisture is the chief climatic factor affecting the yield and protein content of wheat."

Certain relations between root development and tillering in wheat: Significance in the production of high-protein wheat. W. F. GERICKE (*Amer. Jour. Bot.*, 9 (1922), No. 7, pp. 366-369).—Wheat cultures of large root development tillered much more profusely when placed in nutrient solutions than did those with comparatively small root development. Evidently the former absorbed more nutrient than needed for normal development of shoots, and the consequence was a greater vegetative response in the form of tillers. Cultures of similar root development differed in the number of tillers produced, depending on the kind of nutrient supplied. The data obtained with these solution cultures seem to show why good tillering was obtained with the soil cultures described earlier (E. S. R., 47, p. 233).

Common weeds. W. G. SMITH (*Scot. Jour. Agr.*, 4 (1921), Nos. 1, pp. 14-28; 2, pp. 129-140; 3, pp. 282-290; 4, pp. 382-394; 5 (1922), No. 1, pp. 39-49, figs. 29).—Descriptions and control methods are given for the weeds found on farms in Scotland, with notes on dissemination. Both annual and perennial types are grouped according to flower color.

HORTICULTURE.

[Report on horticultural investigations] (*Expt. and Research Sta., Oshesunt, Herts., Ann. Rpt., 7 (1921), pp. 7-31, figs. 2*).—The activities of the year 1921 were for the most part in direct continuance of previously noted work (E. S. R., 45, p. 538). In order to standardize the results of successive years a definite system of grading tomato fruits embracing six different classes was adopted.

Greenhouse experiments with Ailsa Craig tomatoes indicated that in well-fertilized soils little or no advantage accrues from mulching. Dung mulched plants yielded at the rate of 47.56 tons per acre, while unmulched plants yielded 47.21. In another house in which straw mulch was compared with no mulch the yields were 43.45 and 45.76 tons, respectively, indicating a slightly deleterious effect on the part of the straw. The proportions of high-grade fruits were practically the same on all four plats. In order to study the effect of forcing air through the soil upon the quality and quantity of fruit and upon the ability of the plant to resist disease, conductors in the form of loosely joined, unglazed 3-in. pipes were embedded in a bed of clinkers below the surface of the soil. Twice daily, at 9 a. m. and at 4 p. m., air drawn from within the greenhouse was forced through the pipes for 15-minute periods. Kondine Red tomatoes, set in the house on March 3, were used as plant material. Pumping was begun on March 18, and continued for 28 weeks. A tabulation of yields shows an increase of 10 per cent for the forced air plat above the check (sealed pipe) plat. A third plat in which the pipes were open at one end outdoors gave an increase of 6 per cent above the checks. The foliage of the aerated section was consistently better, the flowers appeared earlier, and the fruit matured a week sooner than on the control plats. Toward the close of the test a marked superiority was recorded in the ability of the aerated plants to resist mildew.

The results of nutritional investigations with tomatoes showed some departures from previous years. The omission of potash gave a slightly increased yield. The amount of sunlight occurring during the growing period is believed to play an important rôle in relation to the value of different component plant foods. Whereas in previous years the omission of nitrogen had resulted in increased yields and the omission of potash had greatly reduced yields, diametrically opposite results were obtained in 1921. These variations are believed to be due to the favorable weather conditions prevailing during the greater part of the season.

The depressing effect of chemical nitrogen in the form of ammonium nitrate on cucumber yields was again demonstrated, in that the omission of nitrogen from an otherwise complete formula resulted in an increase of 4 lbs. per plant above the completely fertilized sections. When manure was added to both plats, a difference of 5.07 lbs. per plant was recorded in favor of no chemical nitrogen. In soil sterilization tests in which steam, carbolic acid, formaldehyde, and hot water were compared as media, carbolic acid again showed very effective results.

[Vegetable investigations at the California Station] (*California Sta. Rpt. 1921, pp. 88, 89, 93*).—Irrigation studies with the Stone tomato at the University Farm showed an increased production of large symmetrical fruits on the irrigated plants. Not only did the irrigated plants ripen their fruits five weeks earlier, but there was also a considerably less percentage of unproductive plants.

Field inspection of the asparagus-growing industry in the Sacramento Valley and in the San Joaquin Delta showed that approximately 90 per cent of the

plants were of the Palmetto variety. One-year plants of this variety set at the University Farm in January, 1917, yielded at the rate of 2,071 lbs. per acre in 1919 and 2,426 lbs. in 1920.

Inheritance studies with the radish (*Raphanus* spp.), conducted by H. B. Frost at the Citrus Substation, showed that red color in the root, stem, and flower is recessive to purple, and white in the root and flower is in general recessive to red or purple. A case of linkage between color and size or habit genes was found, the red gene and a fleshy root or lateness gene giving only about 5 per cent of crossovers. The black rooted and white rooted forms almost invariably carried purple.

Vegetable growing in Guam, G. BUGGS (*Guam Sta. Bul.* 2 (1922), pp. 60, pls. 17).—A thorough discussion of vegetable production on the island of Guam, based for the most part on investigations conducted at the station. Detailed information is presented relating to soils, climate, seed, preparation of soil, planting, cultural operations, and protective measures for the control of insect, fungus, and animal pests. In addition, detailed cultural directions are given for the individual species in connection with varietal and other data obtained in experimental work.

Control of insect pests and diseases of vegetable crops (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 89-97).—In connection with formulas for the preparation of various fungicides and disinfectants, a comprehensive program, arranged in tabular form, is submitted to assist in the control of pests on all the important vegetables grown in Ohio.

Spraying hillside orchards, F. H. BALLOU (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 82-87, figs. 5).—In order to emphasize the value of proper planning as a means of lessening the burdens in spraying steep hillside orchards, the author describes in general terms some of the conveniences provided on a fruit farm in central Ohio. The tree rows were arranged in conformity with the contour of the land, thus making possible the construction of roads on easy grades. An adequate water system was installed which provided for a large sized tank located at a high point in the orchard, with hydrants available wherever the pipe lines crossed the roads. It is recommended that spray outfits for hillside work be so constructed that the center of gravity be as near as possible to the ground, and that much longer leads of hose be provided than are usually used on more level land.

[Pomological investigations by the California Station] (*California Sta. Rpt.* 1921, pp. 50-52, 53-55, 64, 65, 66, 74-77, 79, 80, 81, 82, 83).—A progress report (E. S. R., 44, p. 737) for the year ended June 30, 1921, in which various activities are briefly discussed, for the most part without the inclusion of data.

Spacing studies conducted by F. W. Allen with fruit trees planted in 1915 at varying distances apart have shown that apricots and peaches at 12 ft. have already begun to injure one another. At 20 ft. the trees have made twice as much growth as at 12 ft. but are, nevertheless, crowding. French prunes, Bartlett pears, and Napoleon cherries set at 12 ft. have as yet not been injured.

Irrigation studies in deciduous orchards, by F. J. Veihmeyer, indicate the impossibility of bringing the lower soil to a given moisture content until the upper layers are thoroughly saturated. In studies at Davis a close relationship was disclosed between the moisture equivalents of soils as determined by the Briggs and Lane method and their field capacities. Investigations, conducted separately by Veihmeyer and A. H. Hendrickson, indicated that trees transpire very rapidly following irrigation, and these observations are believed to show the impossibility of maintaining an even moisture content in soil

within the depth occupied by the tree roots. Incomplete irrigation experiments in mature prune orchards in the Santa Clara Valley suggest the advisability of applying water three times a year, in April or early May, in July, and immediately following harvest. Of these three times, the spring application is considered the most important. No difference was apparent in the quality of irrigated and nonirrigated peaches and prunes. No increase in the percentage of cracked prunes was found following irrigations provided the soil had not been allowed to become too dry preceding the application of water. In normal seasons of rainfall Santa Clara orchards irrigated in winter are depleted of moisture to a depth of 6 ft. at the same time as other orchards receiving no winter irrigation. Measurements on the length growth of irrigated and nonirrigated 4-year-old French prune trees showed that watering has a decided stimulating effect on such growth. Whereas the nonirrigated trees formed their terminal buds in June, the others continued to grow throughout the season and showed a marked tendency to increase the rate of growth beginning about 10 days after each irrigation. The deleterious effect of close spacing was shown by the fact that the more closely planted trees, both in mature and in young orchards, suffered sooner from the lack of water.

Studies by H. S. Reed at the Citrus Substation on the growth of Bartlett pear trees are again reviewed (E. S. R. 45, p. 836). Hendrickson found that while the concentration of the sap of both the fruit and the leaves in peaches, apricots, and prunes increased with the advancing season, the concentration of the sap of the fruit increased the more rapidly, thus preventing the transfer of sap from fruit to leaves during periods of water scarcity.

Experiments by W. P. Tufts in the pruning of young fruit trees showed that severe heading delays fruiting from one to three years. Severely pruned Royal apricot trees planted in March, 1916, have to date borne two crops, totaling 1.1 lbs. per tree, while similar trees subjected only to slight thinning have borne three crops totaling 81.3 lbs. per tree. Furthermore, light pruning has favored the better development of the tree itself.

Pollination experiments with apples, plums, peaches, and nectarines are briefly reported. Among the self-sterile varieties were Gravenstein, Yellow Bellflower, White Winter Pearmain, and Red Pearmain apples and the Eldorado, Duarte, June 24, Diamond, President, and Quackenboss plums. The set of fruit on many of the self-fruitful varieties was materially increased by cross-pollination, and certain varieties are listed as being distinctly compatible. Honeybees are recognized as important factors in proper pollination.

Analyses of prunes from fertilized and unfertilized soils showed no significant differences in sugar or moisture content.

In storage studies with various fruits, conducted by E. L. Overholser and others, it was found that certain varieties of peaches, including the Elberta, could be kept for six weeks or longer at 32° F. Other varieties, including Hale Early, Eureka, Carman, etc., were unsatisfactory for storage. Kelsey, Grand Duke, and Wickson were exceptionally good keeping plums in cold storage. Although practically all apricots were poor keepers, a distinct correlation was noted between the keeping and shipping quality in this fruit. The Tilton apricot, held successfully for two months in cold storage, is a very good shipper. The results of the storage work indicate that 31 to 32° is the best temperature for peaches, plums, and apricots; 30 to 32° for pears; and 40° for avocados. The Easter pear is first in a list of varieties arranged according to keeping ability. Peaches, apricots, and plums picked when too immature were found to be inclined to wilt and never attain satisfactory quality. Pears, with the exception of the Bartlett, were also observed to suffer from too early

picking. It was found that various fruits, including the strawberry, raspberry, cherry, loganberry, blackberry, gooseberry, currant, fig, plum, peach, and apricot, could be held at 10° for a year without deterioration in flavor or color, when the fruit was placed either in sealed containers, in water or sugar solutions, or crushed with or without the addition of sugar. English walnuts, both bleached and unbleached, were satisfactorily kept nearly two years by storage at 10°, showing no apparent deterioration in quality, texture, or color.

Reports of experiments with citrus fruits include a previously noted discussion of the regeneration of roots (E. S. R., 45, p. 440). In variety studies at the Citrus Substation, the Early Navel, Bessie, Brazilian, and Star oranges; the Clementine and Willow-leaf mandarines; and the Sampson tangelo have attracted favorable attention during the year. A 60-acre citrus orchard planted in 1917 has continued to make satisfactory progress under the cover crop and no fertilizer system of management. Work in citrus orchards located on dry-bog adobe soils in Tulare County indicate that it is undesirable to allow irrigation water to remain in the furrows for more than 48 hours, that subsequent tillage should be delayed until the soil is again moderately dry, and that fall or winter plowing is a good practice.

Among many promising varieties of grapes tested at Davis, Black Monukka and Molinera are considered very promising. Studies with phylloxera resistant grape stocks and with the cordon system of pruning are again briefly noted (E. S. R., 46, p. 540). Individual records for five years taken on 860 Muscat vines showed a considerable variation in yield per plant. Olive pruning experiments are again noted (E. S. R., 46, p. 140).

The Ehrhardt Persian walnut, disseminated by the Citrus Substation in 1919, is reported as having received considerable commendation. The Rutherford, another recently named seedling nut, is considered of promise. Field trials conducted in walnut groves, in which various fertilizers were used with and without cover crops, have shown no significant effect of fertilizers on the production of nuts.

Methods of interpreting yield records in apple fertilization experiments, R. D. ANTHONY and J. H. WARING (*Pennsylvania Sta. Bul. 173 (1922), pp. 3-42, figs. 3*).—This paper presents a mathematical analysis of the results of fertilizer experiments in progress in several Pennsylvania orchards since 1907 (E. S. R., 35, p. 540). The authors endeavor to show that certain factors, namely, contour of the land, variations in the character of soil, and number and distribution of varieties, may play a very important rôle in determining the results, in many cases offsetting variations in yield often attributed to fertilizers. Furthermore, the fact that all the trees included in the experiments were grafted upon seedling stocks of unknown origin is believed to further complicate the results.

Of the six projects considered separately in the text, project 215, a study of the value of various fertilizers in an Adams County York and Stayman orchard, conducted upon the tillage cover crop plan, is discussed in greatest detail. A difference of nearly 20 ft. in elevation was present in the experimental area, and in grouping yields of trees according to location the authors found that elevation exerted a very appreciable effect on yields, irrespective of the different fertilizer treatments. A study of the yields of the various plats with respect to variety showed that the rank of the plats when both varieties were considered as a unit was in several cases decidedly different from the rank based on either variety alone. In a study of the value of averages as a means of interpreting the significance of variations in yield, the authors, after comparing two different methods of analysis, the Bessel formula

and the "Student's" method, believe the latter to be of particular value, especially under conditions similar to those obtaining in these experiments. According to this method, there were five treatments which outyielded the adjacent check areas by odds greater than 30 to 1. According to a formula developed by Mitchell and Grindley (E. S. R., 30, p. 369) to determine the number of individuals necessary to demonstrate satisfactorily the significance of differences in average gain, four of the five plats selected by the "Student's" method had a sufficient number of trees to justify the drawing of conclusions. The value of check trees as indicators of normal yield is also discussed. The authors conclude that, from a practical viewpoint, the results of project 215 do not justify the recommendation of any particular fertilizer formula.

A similar study, project 216, located in a Franklin County York and Jonathan orchard also managed on the tillage cover crop plan, resulted in similar conclusions, namely, that there was not a single treatment that could be recommended as giving consistent gains in yield. An analysis of project 220, located in a sod managed York orchard in Bedford County is believed to show clearly that nitrogen, whether in the form of manure or chemicals, is of great importance to soil-grown trees, being in this particular instance the difference between failure and fair success. Project 332, located at State College, is dismissed with a brief statement that with the meager yields to date no treatment has seemed to cause a measurable gain. The use of fertilizer in a permanent sod Baldwin orchard in Lawrence County (project 338) indicated that for this soil a combination of dried blood and nitrate of soda has been of equal value to heavy applications of manure for increasing yield. The addition of phosphoric acid and potash proved of no value. Project 461, located in Franklin County, is reviewed in considerable detail because of the fact that both fertilizers and cultural treatments are compared in the one orchard. It was found that sod without any treatment is incapable of maintaining the vigor of the trees, nearly half the trees dying in one block. Nitrogenous fertilizers and straw mulch were as satisfactory as cultivation with a seeded cover crop. The addition of manure or complete fertilizer to trees grown according to the tillage-cover crop system of management gave no increase in yield. Cover crops proved essential in providing the necessary organic matter.

In general review it is concluded that the experiments show the necessity of reducing the variability of the material under study and increasing the number of individuals under each treatment. The topography of the experimental areas should be such that all plats are equally influenced. The rootstocks upon which the trees are grafted should be of a single clonal variety. Practical deductions are that apple trees growing in a nonlegume sod must receive nitrogenous fertilizers of some form. Commercial carriers of nitrogen have proved as valuable as manure. Trees grown on a tillage-cover crop system of management have not been profitably influenced by the application of fertilizers. The absence of a cover crop from cultivated plats has resulted in reduced vigor of the trees. The complete records of four of the experiments are appended in tabular form.

Leaf characters of apple varieties, J. K. SHAW (*Massachusetts Sta. Bul.* 208 (1922), pp. 21-31, pls. 13, fig. 1).—From careful studies conducted over a period of seven years, the author concludes that apple varieties may be accurately distinguished by careful observation of the leaves, especially those of normal size growing near the middle of the current season's growth. In presenting technical descriptions of the leaves of 26 varieties of apples of more or less importance in Massachusetts, attention is directed to the peculiar characters in the leaves of each variety. These features are further emphasized

by photographic illustrations. Of the various characters utilized for the purpose of identification, namely, length and size of petiole, size and shape of stipules, and size, shape, manner of folding, serratures, texture, pubescence, thickness, and color of the blade, the serratures are described as the most dependable feature. The studies are believed to be of value in assisting in the identification of young trees previous to the time of fruiting, and thereby promoting the accurate naming of nursery trees previous to their distribution.

[**Blooming data on Nova Scotia apples**], P. J. SHAW (*Nova Scotia Sec. Agr. Ann. Rpt.*, 1921 pt. 1, pp. 66, 67).—Based on records taken at 19 different localities in Nova Scotia during the seasons of 1919-20 and 1920-21, tabulated data are presented showing the date of first and full bloom for 17 apple varieties.

Development of the cultivated blueberry, E. C. WHITE (*Amer. Pomol. Soc. Proc.*, 36-37 (1919-1920), pp. 48-61, figs. 4).—In this paper, relating to the improvement of blueberries by selection and by crossing of superior parent plants, the author devotes particular attention to work under way on her estate at Whitesbog, N. J. The cultural, pruning, and spraying practices in operation are described in detail, and two of the improved types of berries are illustrated. The scientific phases of the project are conducted cooperatively with the U. S. Department of Agriculture (E. S. R., 46, p. 140).

The pruning of the olive, J. BONNET (*Vic Agr. et Rurale*, 18 (1921), No. 8, pp. 120-123, fig. 1).—Pointing out that the olive is pruned in multiple forms and at various seasons, the author discusses the fruiting and vegetative habits of the olive tree and outlines a practical system of pruning based on the actual physiology of the tree's development.

Citrus in Brazil, P. H. ROLES (*Fla. Grower*, 25 (1922), No. 25, p. 5, fig. 1).—Since, with one exception, Brazilian citrus species are propagated by natural seedlings, there has arisen a multiplicity of types and forms possessing no well-defined distinctions. The author points out that some of these seedlings have very desirable characteristics which would make them well worthy of asexual propagation and dissemination as named varieties.

Cocos nucifera, F. W. T. HUNGER (*Coroa nucifera. Amsterdam: Scheltema & Holkema*, 1920, 2. ed., rev. and enl., pp. XVI+518, pls. 94, figs. 29).—This enlarged and elaborately illustrated edition of a previously noted work (E. S. R., 36, p. 445) is essentially a monograph upon the coconut, treating in detail of its history, botany, geographical distribution, culture, and utilization.

[**Floriculture at the California Station**] (*California Sta. Rpt.* 1921, pp. 107, 108).—Records by C. L. Flint on the number of blooms harvested from 105 cyclamen plants grown from seed sown in November, 1919, showed a total yield of 1,484 flowers from the beginning of blooming in August to the cessation of cutting on December 15, 1920. Certain of the plants potted in soil to which had been added acid phosphate, potassium sulphate, and dried blood bore a greatly increased number of blooms. Based on studies with fertilizers for the cyclamen, it is suggested that a compost consisting of 1 cu. ft. of heavy garden loam, 0.5 cu. ft. of sand, 1 cu. ft. of well-rotted cow manure, and 1.5 cu. ft. of leaf mold is ideal for this plant. This mixture should be supplemented by the addition of 80 gm. of dried blood, 40 gm. of potassium sulphate, and 20 gm. of acid phosphate to each cubic foot. A comparative test of liquid hen manure and of liquid cow manure as fertilizer for Ophelia roses under glass indicated that the hen manure, when used at too great strength and too liberally, is detrimental to roses, causing in this experiment the death of many plants.

Forcing the lilac by mechanical injury to the buds, F. WIENER (*Ber. Deut. Bot. Gesell.*, 40 (1922), No. 4, pp. 148-152).—This is a brief account of an inves-

tigation conducted by the plant physiology department of the University of Graz concerning the effect of partial crushing of the buds of the common lilac, *Syringa vulgaris*, upon the renewal of growth activities. Buds submitted to pressure of less than one minute duration, sufficient to cause a perceptible flattening but not actual crushing, were placed in a forcing house on November 11, 1921, together with untreated buds. On November 30 the treated buds showed renewal of growth and by December 3 the unfolding of the leaves had commenced. At that time the control buds had indicated no development, and did not up to the close of the experiment on December 8. It is noteworthy that all the treated buds renewed activities at the same time.

In seeking to explain the results of the investigation the author believes that the Haberlandt theory of the formation of a wound excretion, which in turn effects the rest period of the bud, is applicable to his results. Furthermore, it is thought that temperature and chemicals exert an influence similar to crushing. That only a narrow margin of temperature lies between successful stimulation and death of the forced plant material, was demonstrated during the study when plants placed in a 34° C. (93.2° F.) bath forced in excellent shape, while those at 36 to 38° were for the most part killed. Dipping in a strong potassium permanganate solution gave favorable results with some injury to the outer scales. It is suggested that the crushing process may prove of some practical value in the forcing of bulbous flowering plants.

The blossom circle of the year in southern gardens, J. L. DILLON (*New York: A. T. De La Marc Co., Inc., 1922, pp. 201, figs. 104*).—An illustrated text, devoted for the most part to a discussion of plant materials for decorative purposes and their proper utilization.

Plant materials of decorative gardening: The woody plants, W. TRELEASE (*Urbana, Ill.: Author, 1921, 2. ed., rev., pp. XLIII+177*).—This is the second edition of a previously noted handbook (E. S. R., 37, p. 746).

FORESTRY.

Forestry [investigations at the California Station] (*California Sta. Rpt. 1921, pp. 94-97*).—In this brief report of various activities carried on during the year a part of the subject matter, including that relating to white-fir volume tables (E. S. R., 45, p. 838), time studies in logging (E. S. R., 47, p. 540), and experiments with Bishop pine seed (E. S. R., 46, p. 644), has been previously noted.

Observation on the behavior of a large number of tree species in the forest nursery at Berkeley showed a remarkable variation in the ability of different species to adapt themselves to the nursery conditions. Seed of *Juniperus virginiana* and *J. communis* lay dormant for an entire year despite treatment with acid previous to planting. Seed of *Accr saccharum* germinated only 50 per cent during the first season. The application of a solution consisting of one part of Atlas A and nine parts of water to the exposed surfaces following girdling was found successful by W. Metcalf for killing Eucalyptus trees and for preventing stumps from sprouting, and a 15:1 solution destroyed all weeds and grass in a forest nursery.

Reforestation experiments in Mendocino County, in which 15 different species were used in planting, indicated that practically all these species were able to make a satisfactory initial development. Records taken in a 10-year-old blue-gum (*Eucalyptus globulus*) plantation in Mendocino County showed that of a total of 340 trees per acre, the majority, 236 trees, were making a satisfactory growth, with a d. b. h. of 5.1 in. and average height of 52 ft. In addition to the

Eucalyptus trees, various other species were present in large number, giving evidence of a very vigorous natural reproduction.

Progress report on forest administration in the Punjab for the year 1920-21. J. W. A. GRIEVE (*Punjab Forest Admin. Rpt., 1920-21, pp. [24]+LVIII, pl. 1*).—This administration report (E. S. R., 45, p. 646) for the period July 1, 1920, to March 31, 1921, includes brief notes on investigational activities.

Reproduction and nitrogen. E. N. MUNNS (*Jour. Forestry, 20 (1922), No. 5, pp. 497, 498*).—Observing the more rapid growth of young yellow pines within a patch of lupine on a burned-over area in the Stanislaus National Forest in California, the author took measurements of the annual growth on 23 trees within the lupine and on 37 trees in the surrounding area. The data, presented in tabular form, show that after the first three years the lupine-surrounded trees grew much more rapidly than those without, averaging 23 in. taller. The greater vigor of trees among the lupines is believed to be due to the benefit of nitrogen gathered by the bacteria on lupine roots. It is stated that similarly favorable results have been obtained with the use of red clover as a cover crop in forest nurseries.

Rubber [investigations at the Peradeniya Experiment Station, Ceylon], T. H. HOLLAND and M. K. BAMBER (*Trop. Agr. [Ceylon], 58 (1922), No. 5, pp. 258-263*).—Interesting data were obtained as a result of careful records taken over a nine-months period on the yield of young rubber trees, all descendants of a single tree which had produced the largest yield of rubber ever recorded in Ceylon. The trees were planted in 1912, thinned in 1916 to 90 trees per acre, and experimental tapping commenced in April, 1921. The average yield per tree for the nine-months period was 3.59 lbs. of dry rubber. Computations showed that 4.3 per cent of the trees produced between 5 and 6 lbs., 26.1 per cent between 4 and 5 lbs., 47.2 per cent between 3 and 4 lbs., and 22.4 per cent between 2 and 3 lbs. of dry rubber. The average growth for the same four groups of trees was, respectively, 35.48, 31.65, 31.4, and 27.19 in., showing a definite correlation between yield of rubber and size of the trunk. No conclusions are drawn by the author.

An experiment in progress for three years upon the comparative yield of trees tapped at two- and three-day intervals indicated that the two-day interval is decidedly more stimulating in respect to production of rubber. The two-day trees outyielded the three-day trees by 26.4 per cent in 1919, 29.1 per cent in 1920, and 30.4 per cent in 1921.

A comparative test of the effect of five different fertilizer treatments, namely, complete mixture, nitrogen, phosphoric acid, potassium, and no fertilizer, on the yield of rubber trees, the data of which are presented in tabular form, shows that while the complete fertilizer and nitrogen plats have produced the larger yields during the three years 1919-1921 the phosphoric acid treatment leads all others over the period 1913-1921. Potassium evidently exerted a somewhat deleterious effect on yield, less rubber being produced on this plat than on the control. As a whole the differences in yield in favor of fertilized plats are so slight as to lead to a question of the value of applying any fertilizer materials.

Oleoresin production. E. GERRY (*U. S. Dept. Agr. Bul. 1064 (1922), pp. 46, pls. 7, figs. 7*).—A report of an investigation conducted by the Forest Service in order to obtain accurate information on the changes which occur in the wood of pines as the result of turpentineing and, incidentally, to enable the formulation of a rational program of tapping, wherein the maximum production may be obtained with the least possible injury to the trees. The material utilized in the experiment was obtained at different points in Mississippi, Louisiana, and

Florida. Two species of *Pinus*, *P. palustris*, longleaf pine, and *P. caribaea*, slash pine, are described as the chief sources of turpentine.

Following a detailed discussion of the structure of the wood and bark of longleaf pine, the methods employed in the study are outlined and the usual methods of chipping trees are reviewed. In comparing the woody tissue in the vicinity of tapping wounds with that of the untapped trees, it was found that the wounding had a marked stimulating effect on cell formation, especially in the region directly above the cut. The number of resin passages was greatly increased within the first foot above the wound, and even to a vertical distance of from 6 to 9 ft. the resin passages were more numerous than in normal wood. At the same time, the stimulus in a horizontal direction was relatively slight, being hardly noticeable 2 to 3 in. distant. These additional resin passages, of about the same diameter as those in untapped wood, were found to contribute materially to the yield of oleoresin.

Careful studies of different methods of chipping led to the conclusion that this operation is of fundamental significance. Very severe chipping, generally found to be followed by a delay in wood renewal and a very marked reduction in ring width and percentage of summer wood, resulted not only in a rapid reduction of yield from year to year but also caused the death of many of the tapped trees. A conservative program of chipping, in which no tree under 10 in. diameter was utilized, in which one-half or at the very least one-third of the total circumference in the vicinity of the faces was untouched, and in which chipping progressed upward at the rate of not more than $\frac{1}{4}$ in. per week, was found to result in higher yields (40 to 50 per cent) per inch of height of chipped surface, in higher sustained yields from year to year, in a total annual yield approximating or even surpassing the yield from heavier chipped trees, in a very high production of resiniferous tissue, and in a much lower death rate and injury from dry face. Furthermore, a better grade of lumber was available from the trees at the close of the turpentine operations.

It is recommended that the old practice of collecting gum by cutting a deep box in the tree itself be discarded for the use of modern cups. Proper care should be taken to protect the young seedlings from fire and from uprooting by hogs.

DISEASES OF PLANTS.

Some recent changes in the names of plant diseases, G. H. CUNNINGHAM (*New Zeal. Jour. Agr.*, 23 (1921), No. 3, pp. 163-166).—In view of the number of changes made recently in the names of fungi and bacteria causing orchard, garden, and field crop diseases, the author attempts to show, with reasons, what scientific names should be definitely accepted, and to standardize common names so far as New Zealand is concerned. An account is given of the changes necessitated on account of the discovery of the perfect stage, the untenability of the generic name, the international (Brussels, 1910) rules, local names becoming untenable, or previous wrong determinations of the causative organism.

Plant disease [and immunity] (*Gard. Chron.*, 3. ser., 70 (1921), No. 1821, p. 255).—V. H. Blackman is credited with the generalization (with an explanation of the fact) that in no case of definite disease in plants is one attack of a disease known to secure immunity to further attacks.

[Miscellaneous plant disease investigations of the California Station] (*California Sta. Rpt. 1921*, pp. 87, 88, 90, 91).—A description is given of a potato trouble which appeared on the University Farm at Davis during the past season. The plants were generally of small size and bore small wrinkled leaves of a normal color and tubers of reduced size. The tubers showed

brown centers from $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter. The plants were generally scattered throughout the field, growing beside plants which produced a large yield of good-sized potatoes free from disease. The trouble is considered different from blackheart, internal brown streak, or frost necrosis.

Treating seed potatoes for the control of scab, in which tubers were dipped in a solution of corrosive sublimate, did not produce results of any value in the fall crop of potatoes.

E. H. Smith reported the presence of early blight or leaf spot (*Alternaria solani*) occurring in California for the first time.

A fruit rot of strawberries, which has been under observation for several years, is described by E. H. Smith and W. T. Horne. The cortex of the root decays, and this may involve the crown, but often it stops below the crown and the stump sprouts again at this point. The rot is believed to be due to the water-logging of the soil or to sudden drying out after excessive moisture. No parasite has been found which could account for the initial injury. Similar studies were conducted in connection with a stunting of fall potatoes.

A *Fusarium* wilt of cabbage, kale, tomato, and sweet potato is reported, the fungus having been isolated in each case.

Jacob and Leslie have continued studies of pea diseases, and shallow planting was found efficient in avoiding the early damping-off diseases that prevail in heavy soils. Bacteriosis is said to appear earlier than usual, owing probably to abundant rains.

Horne found that mold disease (*Monilia fomicola*) that attacks mushrooms will not be serious, providing vigorous healthy spawn is planted.

Injury to foliage by arsenical sprays.—I, The lead arsenates, H. T. FERNALD and A. I. BOURNE (*Massachusetts Sta. Bul.* 207 (1922), pp. 19, figs. 23).—The results are given of investigations on the effect of pure and commercial acid and neutral lead arsenate pastes and powders when applied to the foliage of apple, cherry, peach, pear, plum, and elm. The materials were applied in the same way in all cases, being thoroughly mixed with the proper amount of water just before using. Spraying was begun in June, continued during July, and a few applications were made on the trees early in August. After the spray had been applied, its effect was observed about twice a week for at least two weeks.

The authors found very little difference in sensitiveness between the upper and under surfaces of the leaves. Where insects or fungi had produced holes in the leaves, spray injury was frequently observed around the edges of the holes, but the rest of the leaf was not affected. In many cases injury did not appear until nearly a week after spraying and increased in severity later. The experiments show that the pear and elm are the most resistant of the trees used, that the apple comes next but is much less resistant, the cherry falls considerably below the apple in this regard, and the Bradshaw plum and peach are about equally sensitive, both being much more injured than the cherry. No injury from either the pure or commercial materials was obtained with a combination of low temperatures and humidities, but traces of injury began to appear as these factors became higher.

A special investigation was made on the effects of temperature, humidity, and light as affecting injury, and the authors found that with reliable arsenicals properly made, mixed, and applied, injury results from the combination of these factors. Neutral lead arsenate proved the safest of the materials used in clear weather, and in most cases it was even better than many of the others in cloudy weather. Clear weather spraying is said to be safer than cloudy weather, and indications were observed that spraying at high tempera-

tures can be done if the humidity is low, or at high humidities if the temperature is low.

The national problem of fungicides based on copper, E. CERASOLI (*R. Staz. Patol. Veg., Rome, Bol. Mens.*, 2 (1921), No. 5-6, pp. 64-71).—A brief discussion of costs, values, chemistry, and industrial preparation of Bordeaux powder and Bordeaux mixture, and of Pasta Caffaro as a protective against plant diseases.

Suppression of molds during the incubation of certain parasitic fungi, R. A. STUDHALTER (*Abs. in Science, n. ser.*, 55 (1922), No. 1429, pp. 547).—The author reports that the suppression of molds during the incubation in a saturated atmosphere of certain parasitic fungi may be accomplished by treating them with such chemicals as powdered sulphur, various concentrations of mercuric chlorid, formaldehyde, copper sulphate, etc. These treatments were effective during the incubation of a species of *Pestalotzia* on the needles of *Pinus radiata*, especially if the chemicals were applied after one to four days of presoaking of the infected needles in water. In investigations of *Lophodermium* sp. no chemical or other treatment was found which was able to suppress the molds without seriously hindering the proper development of the fungus in question.

Studies on fusarioses.—I, Snow mold and stalk fusariosis, T. LINDFORS (*K. Landtbr. Akad. Handl. och Tidskr.*, 59 (1920), No. 7, pp. 424-471, figs. 2; also *Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 203 (1920), pp. 50, figs. 2).—This part of a projected series deals in two sections with the forms of *Fusarium* and associated fungi present in foot and stalk cereal diseases and with remedial or preventive measures, including selection for resistance. The bibliography lists 54 titles.

Cooperative cereal disease investigations (*California Sta. Rpt. 1921*, pp. 42-45).—Brief reports are given of cooperative experiments between the station and the Bureau of Plant Industry, U. S. D. A., for the control of cereal diseases.

Field trials by W. W. Mackie and greenhouse inoculations by R. F. Allen showed a high degree of resistance to stem rust on the part of a number of varieties of oats. Only a single biological strain of oat stem rust was found in studies of rust obtained from the principal oat-producing sections of the State.

In a previous publication (*E. S. R.*, 45, p. 747) Allen called attention to the nature of resistance of Kanred wheat to stem rust. Continued observations have shown that on account of the narrow stomatal slit only about 10 per cent of the germinating spores gain entrance to the host plant, and these, together with the adjacent cells, are soon killed by the reaction of the host plant, leaving dead areas that are so minute as to be seen only with the aid of a lens.

The injury to seed wheat treated with formaldehyde for the control of smut has been previously pointed out (*E. S. R.*, 44, p. 343), and Hurd is reported to have found that the injury was due to the formation of para-formaldehyde through the evaporation of the formaldehyde solution. Mackie reports the increasing use of copper sulphate and lime solutions for the control of wheat smut. Sulphur as a stinking smut fungicide, and solution and dry treatments of wheat for the control of smut, are reported by Mackie and F. N. Briggs. Dry sulphur at the rate of one part to four parts of grain reduced stinking smut, and dry treatments with copper carbonate and copper sulphate and calcium carbonate gave promising results. As a basis for breeding experiments a study was made of 956 varieties and selections of wheat, some of which showed considerable variation.

Mackie found all varieties of wheat subject to sooty mold (*Hormodendrum cladosporoides*), although some resistance was shown by certain varieties.

Resistance to barley scald (*Rhynchosporium secalis*) is indicated on the part of some of the best varieties of barley grown in the State. Breeding experiments to prevent shattering of barley are said to be giving promising results.

The dusting of wheat for bunt or stinking smut, F. D. HEALD and L. J. SMITH (*Washington Sta. Bul.* 168 (1922), pp. 3-15, figs. 5).—The authors report the successful use of dry copper carbonate for the control of wheat smut and describe a machine devised at the station for the rapid treatment of seed grain. The capacity of the machine is about 2 bu., which amount of wheat can be treated in four or five minutes. Treatment with copper carbonate can be made at any time before sowing, and germination seems to be somewhat improved by it.

Bunch velvet beans to control root knot, J. R. WATSON (*Florida Sta. Bul.* 163 (1922), pp. 53-59, figs. 2).—In continuation of investigations on the control of nematodes in truck soils (E. S. R., 45, p. 357), the author gives an account of experiments with bush velvet beans which were cultivated throughout the entire season. The result was a great reduction in the number of nematodes, making it possible to grow snap beans after a single season of cleanly cultivated bush velvet beans.

The potato blight fungus on tomatoes under glass in April, E. S. SALMON and H. WORMALD (*Gard. Chron.*, 3. ser., 69 (1921), No. 1800, pp. 311, 312).—A case is briefly reported in which zoospores obtained from leaf infections of tomato, susceptible to a fungus indistinguishable from *Phytophthora infestans*, caused 98.6 per cent of infection in case of 144 inoculations on 18 leaves from 3 plants of Arran Comrade potato, inoculated and kept moist for 3 days under bell jars in the laboratory. This evidence, bearing upon the possibility of infecting potato plants from blighted tomatoes, is regarded as important.

Mosaic in potato seed stock, G. H. COONS and J. E. KOTILA (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 135-138, fig. 1).—Attention is called to the effect of the mosaic disease on potato production and the possible bearing the disease may have on the production of seed potatoes in Michigan. Thorough roguing, spraying for control of aphids, and planting resistant strains are suggested as means for reducing the disease. Testing foundation stock in the greenhouse during winter is recommended as an additional safeguard.

[A bacterial rot of sugar beets], W. G. SACKETT (*Colorado Sta. Rpt.* 1921, p. 18).—A brief report is given of the rotting of steckling beets in the silos in northern and western Colorado. When examined, the beets showed a soft, viscid, slimy condition. Several different bacteria were isolated from them, and when reinoculated into beets of low sugar content the bacteria produced a soft rot, but when introduced into mature beets containing a relatively high amount of sugar little or no effect was produced. The laboratory experiments were found to agree with field experiments, and it appears that a combination of low sugar in immature beets, together with high temperature in the silos, aggravated the attack.

The mosaic disease of sugar cane, C. B. W[ILLIAMS] (*Trinidad and Tobago Dept. Agr. Bul.*, 19 (1921), No. 2, pp. 49, 50).—Sugar cane mosaic disease has obtained in certain districts a firmer hold in spite of measures indicated, so that a special campaign was found necessary.

First investigations on sugar cane mosaic in Java, G. L. FAWCETT (*Rev. Indus. y Agr. Tucumán*, 11 (1921), No. 9-10, pp. 121-123).—Studies published in 1907 by Kobus and in 1910 by Wilbrink and Ledebøer (E. S. R., 24, p. 648) seem to support the hypothesis that mosaic in sugar cane is a vegetative variation.

[Deciduous fruit disease investigations of the California Station] (*California Sta. Rpt. 1921*, pp. 60-64).—Internal browning of Yellow Newtown apples has been found by Winkler to be due to the growing of apples at low temperatures, storing at a temperature of 32° F., late harvest, storing without ventilation, and wrapping in ordinary wrappers. To prevent injury due to this cause it is recommended that trees be pruned so as to admit sunlight, storing at 40 to 45°, ventilating the storage room, and wrapping the fruit in wrappers that will absorb the fruit esters given off.

In continuation of brown rot studies (*E. S. R.*, 44, p. 743), B. A. Rudolph carried on extensive spraying experiments, using more than 50 forms of treatment, with the result that standard sprays, applied as recommended, gave a considerable measure of control. Additional studies on the organism *Sclerotinia cinerea*, the cause of brown rot, have shown that the ornamental Japanese quince offers a medium for the early propagation of the fungus. The occurrence of brown rot on prunes and peaches is reported, considerable damage being done to ripe peaches in 1920.

Spraying experiments by W. L. Howard and W. T. Horne showed that lime sulphur or Bordeaux could be sprayed on trees in full bloom without injuring the development of the fruit. Self-boiled lime sulphur applied when the fruit was half grown caused serious injury through the reduction in size and late ripening of the fruit.

J. T. Barrett reports the occurrence of bacterial gummosis of cherry in California, and C. O. Smith is continuing studies of resistant crown gall stock on which to top-work with varieties of peach, plum, prune, almond, and apricot.

Experiments are briefly outlined for the control of *Armillaria mellea* on prune and apricot trees, and studies are reported of rootstocks resistant to *Armillaria*.

E. H. Smith and T. F. Hunt have found serious damage of nursery trees, due to *Pythiacystis citrophthora*, which causes brown rot and gummosis of lemons. As the fungus only attacks bark under certain conditions, it is thought that cankers will not spread after planting in orchard form.

A test was made of various commercial preparations for protecting tree wounds, and Howard reports that, all things considered, Oronite appears to be the most satisfactory wound protector for use in the orchard. In January, 1920, Howard dipped almond tree roots in different strengths of copper sulphate solution to determine the effect on gall production, but trees dug in May, 1921, were found to be more or less affected with galls. Dipping the trees in this manner, either in Bordeaux mixture or 5 per cent solution of copper sulphate, while not causing any injury to the trees, is said to be useless for preventing crown gall after infection has been established.

Apple canker and apricot fruit spot (*California Sta. Rpt. 1921*, p. 55).—E. H. Smith has shown that the northwestern canker (*Neofabraea mali-corticiis*) and European canker (*Nectria galligena*), and to some extent the New York canker (*Physalospora cydoniae*), have become rather prominent in the apple orchards along the coast from Humboldt to Monterey. An apricot fruit spot is described, which was found due to cold injury. On the immature fruit white blisters due to the raising of the epidermis were observed, and later the injury to the mature fruit showed a well-defined scabbing and blackening in irregular blotches.

Black spot of apple and pear.—Finding of the winter-spore form of the organisms in New Zealand (*New Zeal. Jour. Agr.*, 23 (1921), No. 4, pp. 215-221, figs. 2).—Two short articles are published together, the perithecial stages of apple and of pear black spot having been discovered independently and almost simultaneously by the authors.

The first article, by K. M. Curtis, discusses the significance of the development in New Zealand of the perithecia of the apple and pear black spot organisms (*Venturia inaequalis* and *V. pirina*, respectively), in connection with weather and other conditions. The second note, by G. H. Cunningham, records the presence in New Zealand of the perithecial stages of apple and of pear black spot, discussing briefly the appearance of the perithecia of the leaves, the life history of the fungus, and the significance of facts observed in their bearing upon control of the diseases.

Michigan raspberry diseases, G. H. COONS (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 138-141, figs. 4).—Black raspberries are said to be specially subject to anthracnose and cane blight. For the first disease spraying with lime sulphur is recommended. For cane blight cutting out all dead or wilted canes immediately after picking time is suggested. Rejection of affected plants at planting time is advised for control of crown gall.

Red raspberries, while somewhat subject to the above diseases, are particularly susceptible to raspberry curl and raspberry mosaic. These two diseases, while quite similar, are believed to be distinct. All parts of the plant are affected and rendered useless. Roguing, spraying for the control of plant lice, planting resistant varieties, and growing nursery plants that can be closely inspected are suggested as means for the control of these diseases.

Gooseberry mildew control, E. HENNING and T. LANDFORS (*Meddel. Centralanst. Försök. Jordbruksområdet*, No. 208 (1920), pp. 51, figs. 18; also in *K. Landtbr. Akad. Handl. och Tidskr.*, 59 (1920), No. 6, pp. 355-400, figs. 18).—A chronological account is given of the outbreaks of American gooseberry mildew at different points in continental and insular Europe from 1899 in Ireland to 1914 in France, also an account of direct and indirect measures tested for decreasing the loss from this disease. The first publication gives a bibliography of 99 titles.

Splitting and souring of Smyrna figs (*California Sta. Rpt. 1921*, pp. 80, 81).—J. E. Coit and J. C. Johnston have investigated the splitting of figs, and find that it is due not to overcapricification but to the inability of the Smyrna fig to resist excessive turgor. It occurs usually at night when low temperatures and high humidities prevail. Souring is said to occur when conditions favorable to splitting are extended over a few days' time. No specific organism was found to be responsible for decay.

The olive-knot organism (*California Sta. Rpt. 1921*, p. 77).—C. O. Smith reports the successful inoculation of the swamp privet (*Adelia acuminata*) with the olive-knot organism. Definite galls were produced on this host, but while certain reactions were observed on other host plants no galls were formed.

Avocado diseases, H. E. STEVENS (*Florida Sta. Bul.* 161 (1922), pp. 3-23, figs. 6).—Description is given of a number of diseases to which the avocado is subject, and suggestions are given for their control. Among the diseases described are the avocado scab (*Cladosporium citri*), black spot (*Collectotrichum* sp.), avocado blotch (*Cercospora* sp.), rusty blight (*Gloeosporium* sp.), powdery mildew (*Oidium* sp.), and russet fruit. Bordeaux mixture was efficient for the control of all the diseases except powdery mildew, for which lime-sulphur solution is recommended, and russet fruit for which no definite suggestions are made.

[**Citrus disease investigations by the California Station**] (*California Sta. Rpt. 1921*, pp. 83, 84).—H. S. Fawcett and Camp have definitely established a former conclusion that *Bacterium citriputeale*, the cause of citrus black pit, and *B. citrarefaciens*, causing citrus blast, are the same species of microorganism. These two diseases are considered different manifestations of effects produced

by the same organism. It is further brought out that infections leading to the disease are usually brought about by south winds accompanied by driving rains which produce tears, scratches, scars, etc., in fruit.

Fawcett, investigating the report of the occurrence in California of stem-end rot due to *Phomopsis citri*, found a few mature lemons in two packing houses and also a few grapefruits affected with a mild case of melanose. Further investigations for the control of psorosis are said to indicate the importance of treating the disease in its earliest stages.

E. T. Bartholomew is continuing a study of the internal decline of lemons, in which it was found that the rate of growth of lemons is most rapid during April, May, and June. The water content of the blossom end of the healthy fruit is higher than that of the stem end, and the H-ion content of the two ends of the healthy fruit is practically the same. Repeated attempts to isolate an organism that might be the cause of the disease have given negative results.

Fungoid diseases attacking lemons (*New Zeal. Jour. Agr.*, 23 (1921), No. 2, pp. 108, 109).—Spraying tests are briefly outlined as carried out during the seasons 1918-19 and 1919-20. These tests employed lime sulphur and Bordeaux mixture, being intended to determine the best spray, the most economical period for spraying lemon trees, and the proper strength for control of verucosis, gray scab, and *Pythacystis citrophthora*.

Bordeaux mixture maintained first place as a spray to control fungus diseases, the 4-4-40 formula being sufficient for this purpose when used twice annually at the proper times. In cases of bad infection, requiring the 5-5-40 or the 6-4-40 strength, defoliation results. Bordeaux used to excess, even though necessary, is apt to leave its mark on both fruit and tree. Lime sulphur leaves both fruit and tree with a better appearance and scorches the wood less, but is not so effective. Its greatest drawback is its failure to control the diseases effectively without causing considerable defoliation. Bordeaux mixture is recommended to be used after the petals fall, following the main and the fall blooming season.

Diseases [of the oil palm] (*Bul. Imp. Inst. [London]*, 18 (1920), No. 2, pp. 236, 237).—In this portion of a series of general articles bearing on the cultivation of the west African oil palm (*Elaeis guineensis*), with special reference to the East Indies, it is stated that the oil palm has hitherto been remarkably free from serious pests and diseases, both in the wild state and on the plantations. A root disease is noted herein as common and widely distributed in the Belgian Congo, apparently due to *Ganoderma tumidum*. It generally attacks mature trees, though young palms are sometimes killed. A similar disease, due to *G. applanatum*, is said to be very prevalent in San Thomé, attacking the base of the trunk both above and below the surface of the ground and forming a large cavity, which so weakens the stem that the palm breaks down.

Pests [and diseases] of the oil palm in the Portuguese Kongo (*Bul. Imp. Inst. [London]*, 19 (1921), No. 2, pp. 205-207, pls. 6).—R. Swainson-Hall is credited with particulars regarding a disease, closely related to that noted above, attacking the oil palm in the Portuguese Kongo. The fungus is *Ganoderma lucidum* (*Fomes lucidus*), and is closely related to *G. applanatum*, or identical therewith. The disease is described.

[Walnut disease investigations of the California Station] (*California Sta. Rpt. 1921*, pp. 79, 80).—In a previous publication (E. S. R., 47, p. 250) L. D. Batchelor and H. S. Reed showed the relationship between early fall injury and the condition of growth in walnut shoots. Further investigations have shown that frost injury and die-back of rapidly growing trees were pre-

vented in the fall of 1920 by terminating the irrigation season earlier and making the last application of water in August in small amount.

Batchelor and J. T. Barrett briefly describe moldy walnut kernels, in which nuts that have fallen from the trees have the husks partly open. Several fungi were isolated from moldy kernels, a species of *Alternaria* being the most common.

The relation of walnut catkins and pollen to blight is pointed out, both being found subject to attack. Preliminary tests indicate that the walnut-blight organism lives in the soil for a very short period of time.

An undescribed fungus of the pepper tree, J. G. BROWN (*Abs. in Science*, n. ser., 55 (1922), No. 1429, pp. 547, 548).—The pepper tree (*Schinus molle*), which is grown extensively in the warmer parts of the Southwest, is said to be attacked by a fungus which causes extensive rotting of the wood, eventually resulting in the death of the tree. The name *Inonotus schini* n. sp. is proposed for the fungus. As a result of the author's investigation, it was found that infection by this organism was through frost and windstorm injury and from improper pruning.

A new disease of the Douglas fir in Scotland, M. WILSON (*Roy. Scot. Arbor. Soc. Trans.*, 34 (1920), pt. 2, pp. 145-149, pls. 2).—At intervals during 10 years the author's attention has been called to injuries presenting two types, which are here briefly described, on Douglas fir sent from localities in Perthshire, from near Forres, and from Argyllshire, Dumfries, and Inverness, this distribution showing supposedly that the trouble was widespread and probably increasing in Scotland.

The attacking fungus, supposed at first to be *Phoma abietina*, proved to be a new species, and is technically described in the present article, as in the account noted from another source (*E. S. R.*, 46, p. 244), as *Phomopsis pseudotsugae*.

The diseases of the Douglas fir, M. WILSON (*Roy. Scot. Arbor. Soc. Trans.*, 35 (1921), pt. 1, pp. 77, 78).—After the publication of the paper above noted, the author's attention was drawn to records presumably referring to the same fungus (*Phomopsis pseudotsugae*), appearing about 1896-1898 and 1911, respectively, from which evidences it is supposed that *P. pseudotsugae* has been present in the country for a considerable number of years, though at first not so widespread. Other and more recent accounts are cited as bearing upon the presence, prevalence, and injuriousness of this fungus on Douglas fir.

A Phomopsis disease of Douglas fir, N. L. Acock (*Gard. Chron.*, 3. ser., 69 (1921), No. 1778, p. 45, fig. 1).—Subsequent to the conclusion of his own observations on a destructive disease of Douglas fir due to a fungus supposed by him to be *P. pithya*, the author noted the above account published by M. Wilson describing the causal fungus as *P. pseudotsugae*, and he adds herein to Wilson's list of Scottish localities infested with the disease a list of English localities from which diseased specimens have been received. He gives also an account of certain generic and specific characters of the fungus, and of the forms and results of its attack. The disease is causing serious loss among the Douglas fir plantations in England.

Phomopsis pseudotsugae on the Douglas fir (*Gard. Chron.*, 3. ser., 70 (1921), No. 1814, p. 167).—To the facts regarding *P. pseudotsugae* on Douglas fir, as contributed by Wilson (*E. S. R.*, 46, p. 244), is added the statement that the fungus has been recorded as occurring also on *Tsuga* and on Japanese larch, producing symptoms similar to those shown on Douglas fir. The disease is extending, recent records showing 50 per cent infections on individual plantations in Scotland, where it is already widespread. Serious loss is suffered

also in English plantations. The degree of mortality appears to vary with the locality.

White pine blister rust in the western United States (*U. S. Dept. Agr., Dept. Circ. 226 (1922), pp. 7, pls. 2, figs. 4*).—The occurrence is reported of the white pine blister rust (*Cronartium ribicola*) in western British Columbia and the Puget Sound region of Washington. The disease is briefly described, and its control by the eradication of the alternate hosts (*Ribes* spp.) is recommended.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

[Report on insect and insect control investigations at the California Station] (*California Sta. Rpt. 1921, pp. 41, 42, 56-60, 66, 80, 84, 85, 97, 98, 122, 123, 133*).—In control work with the beet leafhopper, particularly with Nicodust, E. A. Schwing has found that if the application is heavy enough (from 100 to 150 lbs. per acre), all insects hit are destroyed.

Studies by E. R. de Ong of the codling moth in mountain apples in the Paradise region of Butte County, where it is causing a heavy loss, show that the growers are not spraying late enough to control the second brood of moths, and that the time for summer sprayings varies from that in the valley, necessitating a careful study of its local life history. The variation of infestation in winter apples ranged from 1 to 99 per cent, with an average of 48.2 per cent, on treated trees.

In combating pear thrips with Nicodust, 4 and 5 per cent strengths were proved by E. O. Essig very satisfactory, but the tests with 2 per cent dust were not conclusive. The results show Nicodust to be a safe method of controlling pear thrips in prunes, pears, and cherries. The use of Nicodust in sprays for the control of the apple aphid and the rosy apple aphid (*Aphis malifoliae* Fitch) was commenced in Sonoma County. In combating Baker's mealybug (*Pseudococcus maritimus* Ehrh.), which seriously infests a number of pear orchards in the Santa Clara Valley, particularly the French varieties of pears (which are inclined to have rough bark on the trunks and larger limbs), the lighter oil emulsions and miscible oil sprays were for the most part efficient in killing all of the exposed eggs, young, and adults. A homemade crude carbolic and distillate emulsion was also used.

Crude oil emulsion and dormant lime-sulphur sprays were again used by Essig against the clover mite on prunes and found to be very effective as ovicides. Sulphur dustings commenced soon after the eggs began to hatch and repeated at intervals resulted in nearly freeing the trees of the mites.

In observations of the red spider (*Tetranychus telarius* L.), de Ong found it both hibernating and active during the winter. It had left the orchard tree by the end of October, but may feed on the morning glory until the middle of December. During the last of January or in February it may be found on hardy plants such as the mallow, geranium, and violet. Oviposition occurs within a few days after feeding begins. Excellent control of the clover mite was obtained by the use of lime sulphur (33° B.) 1 in 50, plus 3 lbs. of steamed flour paste as a spreader. Dusting sulphurs were found less satisfactory than liquid sprays, apparently owing to a lack of adhesiveness. The addition of a filler of hydrated lime or kaolin gives a better mechanical effect to sulphur, overcoming the tendency to pack and giving a better distribution. Crude oil emulsion as a control for Bryobia has given as good results at 4 per cent as the commonly used strengths of 12 and 15 per cent.

In aphid control work with Nicodust 4 and 5 per cent of Blackleaf 40 gave the most satisfactory results. A list is given of 13 of the aphids which may

be controlled by this method. In preliminary experiments conducted on sweet cherries at Vacaville, W. P. Duruz observed that the application of 6 per cent Nicodust at various stages of the bloom does not produce any material effect on the final set of the fruit.

In spraying for the peach twig-moth on 4-year-old almond trees, various materials were applied at three different stages, namely, when the trees were dormant, when the buds were swelling, and when the trees were in full blossom. The results were as follows: "Nicotin sulphate (Blackleaf 40) 0.75 pt., plus 3 lbs. hard soap to 100 gal. water, gave excellent control when applied as a spray when the buds were swelling and also when the trees were in full blossom. Zinc arsenite 2 lbs. to 100 gal. of water gave 100 per cent control when applied when the trees were in full blossom. Liquid lime sulphur (Rex), 1 in 10, gave good control at all three stages, but the best control was obtained when the trees were sprayed while dormant. Dry barium sulphur compound (B. T. S.) produced fair control when applied as the buds were swelling and when the trees were in full bloom. Dry lime sulphur showed inferior results as compared to liquid lime sulphur, but gave better control than dry barium sulphur when applied at the stage of full bloom. Crude oil emulsion, distillate emulsion, and miscible oil (Spra-Mulsion) were not at all effective in the control of this insect. These results show that the peach twig-moth can be controlled through a longer period in the spring than has heretofore been practiced. The commonly recommended treatment is lime-sulphur spray applied at the time buds are swelling. In case this application has been omitted, the insect may still be effectively controlled by an application of nicotin sulphate, arsenite of zinc, or with lime sulphur when the trees are in full bloom."

In spraying experiments for the control of the cherry fruit sawfly (*Hoplocampa cooki* Clk.), Duruz found it to be effectively controlled by the use of liquid lime sulphur in combination with nicotin sulphate (Blackleaf 40) or miscible oil (Rex 35) in combination with nicotin sulphate applied when the blossoms are opening.

In experiments by deOng with dried fruit infested with all stages except the egg of the Indian-meal moth, the dried fruit beetle (*Carpophilus hemipterus* L.), the saw-toothed grain-beetle (*Silvanus surinamensis* L.), the cadelle, and mites (*Tyroglyphus* spp.), stored at temperatures of 10, 25, 32, 35, and 45 to 50° F., the insects of all stages experimented upon were dead at the end of three months' continuous storage, excepting at the highest temperatures, 45 to 50°.

In studies by H. J. Quayle of the codling moth in walnuts, apples were suspended on walnut trees alongside of the walnuts and the moths thus given the opportunity to choose between the walnut and apple in depositing their eggs. There seemed to be no marked discrimination, regardless of whether the moth came originally from the walnut or the apple. Spraying gave more effective results than dusting on 60 acres, including four orchards.

In fumigation investigations by Quayle and H. Knight, gas-tight covers have been shown to possess advantages through securing better and more uniform results and by the saving of 50 per cent or more of the hydrocyanic acid gas that is now used under canvas tents.

In spraying experiments for the orange tortrix, Quayle found that arsenate of lead either alone or in conjunction with lime sulphur can be used with safety so far as actual injury to the trees is concerned. Due to the composition of the fruit being injuriously affected by the acid arsenate of lead, it is recommended that only basic or neutral arsenate of lead be used.

In malaria-mosquito investigations, W. B. Herms and S. B. Freeborn found the average number of eggs deposited by anophelines to be much greater than hitherto stated. "The total number deposited in 30 layings of *Anopheles occidentalis* by 30 individuals was 6,282, in lots ranging from 140 to 315 eggs each, bringing the average per laying to 209 eggs. For 33 *A. punctipennis*, in 33 layings the total was 6,700 eggs, ranging from 83 to 321 per laying, giving an average of 203 per laying for this species. For *A. pseudopunctipennis* the average, based only on the layings of 2 individuals, was 106 per female. In all cases the deposition of the individual eggs took place at remarkably regular intervals of from six to seven seconds. The eggs of *A. occidentalis* are able to withstand desiccation up to but not beyond 72 hours, while those of *A. punctipennis* failed to hatch after 24 hours of drying."

Cooperative experiments by deOng and C. L. Roadhouse have shown that 10 oz. of sodium cyanid (98 per cent pure) per 1,000 cu. ft., in tight rooms with 24 hours' exposure at temperatures of 65° or above, will kill the adult cheese skippers, pupae, and exposed larvae, and the cheese mites *Tyroglyphus siro* Gerv. and *T. hintreri* Gerv. Not more than 97 per cent of skippers feeding in a 23-lb. cheese could be killed either by the above dosages of cyanid or by 24 lbs. of carbon disulphid per 1,000 cu. ft. However, since they migrate to the surface to pupate and then become susceptible, it is possible to eradicate them by two or three properly timed fumigations. Studies of the absorption of fumigating gas by cheese show that it is possible to safely fumigate a cheese-curing room without removing the contents, thus preventing the spread of infestation and avoiding the expense of handling and separate fumigation of the cheese.

Cooperative experiments by deOng and J. F. Wilson showed that the sucking lice of sheep (*Linognathus pedalis* Burm.) were controllable with commercial cresol dips at recommended strengths.

Report on economic insects, F. HERRMANN (*Landw. Jahrb.*, 56 (1921), *Ergänzungs.* 1, pp. 92-105, fig. 1).—In this annual report of the work of the year, accounts are given of studies of the life history and habits of *Orgyia antiqua* L., of observations of the biology of *Melolontha vulgaris*, of investigations of the action of arsenicals as insecticides and the use of arsenicals in combating the codling moth, *M. vulgaris*, *Phyllotreta nigripes*, and *P. nemorum*.

Insect pests of lucern and clover, J. G. MYERS (*New Zeal. Jour. Agr.*, 23 (1921), No. 3, pp. 156-162, *figs.* 1-3).—This is a report of observations in the Marlborough seed-growing area in New Zealand.

Control methods for insects injurious to the peach, W. B. MAREE (*N. C. Agr. Col. Ext. Circ.* 129 (1922), pp. 8).—This is a popular summary of information.

Insect problems of the pineapple industry, D. T. FULLAWAY (*Hawaii. Forester and Agr.*, 19 (1922), No. 1, pp. 5-12).—This is a general discussion of the subject.

Insects that hunt the rose, C. R. CROSBY and M. D. LEONARD (*Amer. Rose Ann.*, 1922, pp. 89-100, *figs.* 8).—This is a revision of the account by the authors first printed in the American Rose Annual for 1916 (*E. S. R.*, 35, p. 345).

Beneficial insects (*Min. Agr. and Fisheries* [London], *Misc. Pub.* 37 (1922), pp. 11, *pls.* 2).—This is a popular summary of information, and includes colored plates illustrating some of the more important beneficial insects.

The flower thrips, J. R. WATSON (*Florida Sta. Bul.* 162 (1922), pp. 25-51, *figs.* 4).—This is a report of observations of flower thrips in Florida, where *Frankliniella bispinosa* Morg. is by far the most common species in all except

the extreme southern part of the State, where it is largely replaced by *F. cephalica masoni* Wat., a closely related form. Its greatest damage is done to citrus. In citrus blooms thrips feed chiefly on the thick fleshy petals and stamens, which turn brownish yellow and drop prematurely. While the damage done to these temporary organs is of no practical importance, some feeding is done on the ovary, or young fruit, and on the expanded tip of the stem which bears the fruit (receptacle). About two weeks are required for the completion of its life cycle at the time of the year when citrus is in bloom. Its feeding may cause the fruit to drop, and the numerous shallow punctures on the surface of the developing fruit may cause characteristic markings which lower the grade. The early investigations of the thinning of fruit resulting from the attack of thrips have been reported upon (E. S. R., 35, p. 852; 37, p. 650).

In several spraying experiments trees were divided into three classes, namely, those with light bloom, those with fair bloom, and those with heavy bloom. "A number of sprayed trees with light bloom produced an average of 252 oranges, while those in the check rows averaged 58. This gave an increase of 344 per cent in case of sprayed trees. . . . Counts made a few weeks after spraying usually have shown about a 50 per cent increase in the number of young oranges to the trees as compared with those on check rows. The reduction of this increase to 7 per cent indicates that spraying causes the trees to retain, temporarily, more fruit than they can carry to maturity.

"The feeding of the thrips, both adults and nymphs, on the young fruit causes a blemish which lowers its grade at packing time. This blemish is a smooth, shining area, very irregular in shape. The surface is slightly sunken and is lighter in color than the remainder of the skin." The injury is to the skin only, the pulp being unharmed, and the fruit retains its natural shape. The extent of this injury varies greatly in different groves and from season to season, sometimes nearly 100 per cent of the fruit showing more or less marking. Taking the average of the State throughout a series of years, probably 25 per cent of the fruit shows some marking, though considerably less than this is serious.

In summarizing the results of six years' spraying experiments, it is found that one opportune spraying generally reduces the amount of seriously marked fruit by 50 per cent. If from 75 to 90 per cent of the thrips in a grove are killed, spraying is considered successful. Of all the insecticides tested, tobacco extracts have been found most satisfactory. One or 2 lbs. of soap to 50 gal. of water is said to be a satisfactory spreader, but usually the use of lime sulphur at rust-mite strength, namely, 1:70, is recommended. The advantage of lime sulphur over soap is that there are likely to be a few rust mites or red spiders in the trees at the time of blossoming, and the lime sulphur is more effective against them.

The author also deals briefly with thrips on tomatoes, on strawberries, on deciduous fruits, and on other plants, including dewberries and blackberries, mulberries, peanuts, and roses. The characteristics and history of the insect, and other flower-frequenting thrips, are considered.

The apple sucker (*Psylla mali* Sch.) in Nova Scotia, W. H. BRITAIN (*Sci. Agr.*, 2 (1921), No. 1, pp. 22-24, figs. 2).—The apple sucker, an account of the occurrence of which in Nova Scotia has previously been noted (E. S. R., 47, p. 55), has now spread over a considerable territory, including parts of the counties of Kings, Hants, Halifax, Colchester, and Cumberland, and being most abundant in the Wolfville and Cornwallis districts. In considering control measures it is stated that up to the present time a spray of Blackleaf 40 at a strength of 0.75 pt. to 100 gal. of water, applied at a pressure of 250 lbs. at the "blossom pink" stage, has given the best results. The use of finely

powdered tobacco dust containing 2 per cent or more of Blackleaf 40 also destroys a large proportion of the insects when applied at the same period.

A catalogue of the California Aleyrodidae and the descriptions of four new species, D. D. PENNY (*Jour. Ent. and Zool.*, 14 (1922), No. 2, pp. 21-35, figs. 4).—The author lists 34 species of Aleyrodidae as occurring in California, together with their food plants and the localities in which they are known to occur. The species described as new are *Aleyrodos essigi*, collected on *Ulmus* sp. at Mission San Jose; *Asterochiton corollis*, from *Arctostaphylos manzanita* at Pine Hills, San Diego Co.; *A. diminutis*, from tarweed (*Chamaebatia foliolosa*) at Placerville; and *Tetracurodes herberti*, from black locust at Pleasanton, Alameda Co.

The woolly aphid of the apple and elm (*Eriosoma lanigera* Haus.), II, F. V. THEOBALD (*Jour. Pomol.*, 2 (1921), No. 3, pp. 199-205).—This second part of the account previously noted (E. S. R., 45, p. 660) deals with control measures.

A new gallicolous aphid of the elm and its symbiosis, E. ALFIERI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici*, 14 (1920), pp. 18-32, pl. 1, fig. 1).—Under the name *Eriosoma unopinatum*, the author describes a gall-forming aphid which he considers to be distinct from *E. lanuginosum* and to represent a new species.

A redescription of the type species of the genera of Coccidae based on species originally described by Maskell, II and E. MORRISON (*U. S. Natl. Mus. Proc.*, 60 (1922), art. 12, pp. 120, pls. 6, figs. 37).—This account is based upon a study of Maskell's collection of insects, amounting to 597 numbers, including unstained slide mounts of nearly all the species present and in most cases unmounted material of the same species. Thirty-seven genera and subgenera are described and discussed, in addition to which one new species, namely, *Anoplaspis maskelli*, is described. The paper includes an index to the genera and species.

Observations on two mealy bugs, *Trionymus trifolii* Forbes and *Pseudococcus maritimus* Ehrh. Hom., Coccidae), W. S. HOUGH (*Ent. News* 33 (1922), No. 6, pp. 171-176).—These observations deal with the clover root mealy bug (*T. trifolii*) and the Baker mealy bug (*P. maritimus*), which has been collected from the following additional hosts: Flowering dogwood, roots of goldenrod, hackberry, hazelnut, hickory, maple, *Rhodendron maximum*, and wild cherry.

Report on a preliminary campaign against the Hibiscus mealybug in the Cairo nursery gardens, W. J. HALL (*Agr. Jour. Egypt*, 10 (1920), pp. 1-16).—The author is of the opinion that if certain trees, namely, Hibiscus, mulberry, Grevillea, Zizyphus, lebbek, and Acalypha, are entirely removed from the infected area, small gardens might be neglected and the pest kept well under control and prevented from spreading by a small continuous campaign.

The bagworm (*Oeceticus kirbyi platensis* Berg.)—Campaign of 1920-1921: Two new parasites, J. BRÉTHES (*El Bicho de Cesto (*Oeceticus kirbyi*, var. *platensis* Berg). Campaña 1920-21, Dos Nuevos Parásitos. Buenos Aires: Inst. Biol. Soc. Rural Argentina, [1922], pp. 28, pl. 1, figs. 24).—This is a summary of information on this pest, including data on its natural enemies, particularly the tachinid *Parexorisista caridei*. Among the hymenopterous parasites mentioned are the two new species *Parasetigena platensis* and *Gymnostylia argentina*. Reports of control work, by the author, have been previously noted (E. S. R., 40, p. 855).*

A contribution to the tea leafroller problem, S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 51 (1921), pp. VI+83, pls. 25*).—This is a report upon investigations, particularly biological studies conducted at Buitenzorg, of several important lepidopterous enemies of tea in Java, namely, *Laspeyresia leucostoma* Meyr., *Gracilaria theivora* Wals., and *Homona coffearia* Nietn. The report of studies on natural enemies includes descriptions of several parasites new to science. An English summary of 8 pages and a bibliography of 22 titles are included.

Notes on the Desmodium leaf miner, Pachyschelus laevigatus (Say) (Col.: Buprestidae), H. B. WEISS and E. WEST (*Ent. News, 33 (1922), No. 6, pp. 180-183, fig. 1*).—The authors have observed this species mining the leaves of *Desmodium pendula* at Rutherford, N. J. At Fairlawn, N. J., adults were numerous on *Lespedeza capitata*, and mines, apparently of this species, were noted on *L. bicolor* at Boonton, N. J. At Monmouth Junction, N. J., clumps of *Meibomia canadensis* were heavily infested by it.

Cloth moths, E. McDANIEL (*Michigan Sta. Quart. Bul., 4 (1922), No. 4, pp. 143, 144*).—This is a brief summary of the knowledge of the habits of the clothes moth and means for its control.

Effects following improper methods of extracting Hypoderma larvae from the backs of cattle, S. HADWEN (*Jour. Amer. Vet. Med. Assoc., 60 (1922), No. 6, pp. 724-728*).—The importance of flushing the cavity after the ox warble has been removed from the host in order to remove the toxic material and thus avoid unfavorable after-effects is pointed out by the author.

Notes on the myiasis-producing Diptera of man and animals, W. S. PATTON (*Bul. Ent. Research, 12 (1921), No. 3, pp. 239-261, figs. 2*).—This account includes a key for the identification of some of the larvae of myiasis-producing Diptera.

A trypaneid from Bryonia, Gonyglossum wiedemanni Meig., F. SILVESTRI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici, 14 (1920), pp. 205-215, figs. 4*).—The larva of *G. wiedemanni*, here considered, infests the fruit of *Bryonia alba* and *B. dioica*. A brief account is given of the braconid parasite *Opius testaceus* Wesm., which attacks the larva.

Sheep maggot flies and their allies, D. MILLER (*New Zeal. Jour. Agr., 22 (1921), No. 6, pp. 321-334, figs. 17*).—This is a report of investigations that have been conducted in New Zealand.

North American predaceous beetles of the tribe Tillini in the U. S. National Museum, A. B. WOLCOTT (*U. S. Natl. Mus. Proc., 59 (1922), pp. 269-290, pl. 1*).—This synopsis of the tribe Tillini of the family Cleridae includes descriptions of 10 new forms.

Preliminary notes on the "Kadondong" beetle, Podontia 14-punctata L., G. H. CORBETT and M. YUSOP (*Agr. Bul. Fed. Malay States, 9 (1921), No. 3, pp. 192-200, pl. 1*).—This is a preliminary account of a beetle reported for the first time in 1920 as seriously damaging the Otaheiti apple or "Kadondong" (*Spondias dulcis*) at Kuala Lumpur, including life history studies and control work.

Argilus foveicollis Mars. as a cause of the decay of the culture of roses in Bulgaria, S. A. MOKRZECKI (*Bul. Ent. Research, 12 (1921), No. 3, pp. 353, 354, figs. 4*).—The serious losses in Bulgaria of rose trees, especially *Rosa damascena* Mill., which are extensively grown for making attar of roses, have been found to be due to the stem galls of this new and destructive brucepistid. The pest has not previously been recorded from any locality in Europe.

The sweet potato weevil in Florida, B. L. BOYDEN (*Fla. Plant Bd. Quart. Bul., 6 (1922), No. 3, pp. 76-87, figs. 2*).—This is a summary of information on the present status of the sweet-potato weevil and of control work in Florida.

The banana weevil, S. M. CENDAÑA (*Philippine Agr.*, 10 (1922), No. 8, pp. 367-376, pls. 2).—This is an account of *Cosmopolites sordidus* Germ., which is a serious enemy of the banana in the Philippines and also a serious pest of abaca (*Musa textilis* Nee.), the source of the world's best shipping cordage. All varieties of the banana are, at least to some extent, attacked, and the Bangulanon and Sinamoro Puti varieties of abaca and possibly others are injured by it. The normal spread of the pest is quite slow, its distribution taking place principally by transportation of infested suckers and rootstocks. Infested stools can be freed from it by submerging them in water for at least 72 hours. The use of formaldehyde has no better effect than the water in drowning the weevil. Data on the extent of its injury and studies of its life history are reported, and a bibliography of 14 titles is included.

The bean weevils of California, A. O. LARSON (*Calif. Bean Growers Jour.*, 3 (1922), No. 8, pp. 118, 119, figs. 5).—This is a brief account of bean weevils in California.

Boll weevil poisoning work in 1921, H. B. BROWN and J. F. O'KELLY (*Mississippi Sta. Bul.* 205 (1921), pp. 11-14, figs. 2).—This is a report of work carried on in 1921 in which plats were dusted with calcium arsenate, which was also applied as a water spray alone and with molasses. Due to varying conditions of the soil and the presence of wilt, no definite comparison can be drawn. The comparison between the molasses-water solution and the water solution showed a difference of 213.4 lbs. of seed cotton per acre in favor of the part treated with the molasses-water solution. The results obtained show that the application of poison helped to hold the infestation down for a while.

An experimental investigation of the supposed poisonous qualities of the granary weevil, *Calendra granaria*, F. DEFIEL (*Amer. Jour. Trop. Med.*, 2 (1922), No. 3, pp. 199-211).—The author concludes that the granary weevil contains no cantharidin and can not be used as a substitute for the blister beetle, nor is there any evidence to indicate that it is responsible for cases of poisonous flour. A list of 29 references to the literature is included.

The cost of honey production, E. W. ATKINS (*Minn. Hort.*, 50 (1922), No. 6, pp. 181-184).—In this report on the cost of honey production, details of which are presented, it is pointed out that three factors are essential in order to make honey production profitable, namely, the working out of the most efficient system of management possible in order to cut down the cost of production, an increase of the average production per colony by improved methods, and the maintenance of a fair price.

Instructions on beekeeping, C. C. GHOSH (*Burma Dept. Agr. Bul.* 17 (1921), pp. 11, pl. 1, figs. 9).—This consists of instructions given with an aim to aiding the beginner to start beekeeping with the locally available Indian bees.

Descriptions of some North American sawfly larvae, W. MIDDLETON (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 21, pp. 31, figs. 8).—The species here treated belong to eight genera representing four subfamilies of the Tenthredinidae, and one genus (*Acordulecera*) of the Pterygophoridae. The descriptions are of sawfly larvae which have been obtained in connection with investigations of insects injurious to forest and shade trees and shrubs.

The Ichneumonidea as parasites, F. STELLWAAG (*Monog. Angew. Ent.* No. 6 (1921), pp. 100, figs. 37).—In this work on the parasitic Hymenoptera, part 1 (pp. 3-29) deals with the sexual organs of the female and oviposition, part 2 (pp. 29-53) with development from egg to adult, part 3 (pp. 53-68) with bio-nomics, etc., and part 4 (pp. 68-79) with gradation. Part 5 (pp. 80-92) consists of lists as follows: Parasitic wasps with hosts that live in water, plant inhabiting Chalcididae, parasites and hyperparasites of the olive moth (*Prays*

oleellus Fab.) and the hests, respectively, of *Apanteles glomeratus* L., *Pimpla alternans* Grav., *Oophthora (Pentarthron) semblidis* Auriv., the traubenwickler or grape leafroller (*Conchylis ambiguella* Hub. and *Polychrosis botrana* Schiff.), *Oenophthira pilleriana* Schiff, the brown-tail moth, gipsy moth, and the codling moth. A list of the important literature relating to biological investigations of the parasitic Hymenoptera, arranged alphabetically and consisting of more than 124 titles, is included.

The importation of *Aphelinus mali* into Uruguay to combat the apple aphid, and some observations on the life history of this insect auxiliary, R. SUNDBERG and A. T. PELUFFO (*Uruguay Defensa Agr. Bol. Mens.*, 2 (1921), No. 3, pp. 65-81, figs. 14; abs. in *Rev. Appl. Ent.*, 10 (1922), Ser. A, No. 5, pp. 226, 227).—This is an account of the negotiations and work which resulted in the introduction of this important parasite of the woolly apple aphid into Uruguay from the United States.

New species of ichneumon flies with taxonomic notes, R. A. CUSHMAN (*U. S. Natl. Mus. Proc.*, 60 (1922), Art. 21, pp. 28, fig. 1).—This paper consists of descriptions of 1 new tribe, 2 new genera, and 11 new species of Ichneumonidae, and 5 new species of Braconidae, together with notes on synonymy and generic transfers.

A contribution to the knowledge of the egg parasites of *Oecanthus pelucens* Scop., an achetid orthopteron, F. SILVESTRI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici*, 14 (1920), pp. 219-250, figs. 20).—Of the parasites here considered, five species are described as new. The genus *Archirileya* is erected for one.

The parasite of *Chrysomphalus dictyospermi* Morg. and its introduction into Italy, G. PAOLI (*Coltivatore*, 68 (1922), No. 15, pp. 451-455, figs. 2).—This paper relates to *Aspidiotiphagus lounsburyi* Berl.

A revision of the chalcid flies of the encyrtid genus *Chrysoplatycerus*, P. H. TIMBERLAKE (*U. S. Natl. Mus. Proc.*, 61 (1922), Art. 2, pp. 10, figs. 2).—Three species are recognized by the author, of which *C. ferrisi*, reared from *Pseudococcus adenostomae* Fer., at San Diego, Calif., is described as new.

FOODS—HUMAN NUTRITION.

Nutrition [studies at the California Station] (*California Sta. Rpt.* 1921, pp. 109-117).—Analyses made by M. E. Jaffa and H. Goss are reported of avocados, globe artichokes, canned and dried pears, various crackers, cookies, and similar goods, popped rice, canned turtle meat and bouillon, sapotes, cherimoyas, California-grown bananas, various bottled soft drinks, and the juice of tangelos, an orange-lemon hybrid, and the citrange.

The chemical composition of marine invertebrates, F. BORTAZZI and G. RECCI (*R. Accad. Lincei, Comitato Sci. Aliment. [Rome] Pub.*, No. 10 (1920), pp. 16).—Analyses are reported of a marine alga, *Ulva lactuca*, found in abundance near Naples, and of various marine invertebrates from the same locality.

Amino acids in nutrition.—V, Nutritive value of edestin (globulin from hemp seed): Cystin and lysin as growth-limiting factors in that protein, B. SURE (*Amer. Jour. Physiol.*, 61 (1922), No. 1, pp. 1-13, figs. 7).—Continuing the investigation previously noted (*E. S. R.*, 47, p. 365), evidence is presented that edestin is deficient in lysin and cystin.

The American Red Cross diet in the famine districts of China, H. C. EMBREY (*Amer. Jour. Pub. Health*, 12 (1922), No. 6, pp. 514, 515).—A diet which was adopted by the Red Cross for use in certain famine districts in China and which is said to have given excellent results is described briefly. The diet

consisted simply of bread and soup. The bread contained 40 per cent of ground peanut press cake or ground soy bean press cake, or a mixture of the two, and 60 per cent of millet flour, cottonseed meal, wheat flour, maize flour, or kaoliang (a grain sorghum). The allowance of this bread for 10 men for 1 day was 13.3 catties (17.7 lbs.). The ingredients of the soup for 10 men for 1 day consisted of 4 catties of meal, of which at least 1 should be soy bean meal or peanut meal, 5 gal. of water, 10 catties of fresh vegetables, $\frac{1}{2}$ catty of salt, $\frac{1}{2}$ catty of powdered limestone, chalk, or lime; and 1 catty of pork, bean oil, or any other cheap oil. The meal is cooked in the water for 5 minutes. To this stock are added the other ingredients, and the whole is boiled not longer than 30 minutes. If fresh vegetables are not available, beans are sprouted and the bean sprouts used in their place.

It is said that all the natives on this diet were in splendid health, while those in another section who subsisted on a monotonous diet of kaoliang and millet were in poor health, lacking in energy, and very susceptible to contagious diseases.

The examination of some Indian foodstuffs for their vitamin content, S. N. GHOSE (*Biochem. Jour.*, 16 (1922), No. 1, pp. 35-41).—With a view to determining whether the principal foodstuffs consumed by the mass of people in Bengal contain adequate vitamins, an examination for vitamin A was made of different samples of ghee, mustard oil, and coconut oil, the principal fats used by these people, and for vitamin B of dals (lentils) and samples of Indian flour.

Ghee is made from cow's milk or buffalo milk by warming the raw milk over a low flame for about half an hour, cooling, inoculating with sour milk, and allowing it to stand until curdling is complete. The water is then removed and the curd churned until it becomes a semisolid mass of buttery consistency. Occasionally the product is allowed to turn rancid and then heated and rendered. Samples of pure ghee were found to furnish sufficient vitamin A for the growth of rats when given in 0.4-gm. portions daily. Remelted ghee did not induce growth, but some of the adulterated samples (lard, mutton fat, coconut oil, and almond oil being frequently used as adulterants) were fairly active when constituting 5 per cent of the ration. Coconut oil when incorporated in the basal diet in 10 per cent proportions and mustard oil 10 to 20 per cent induced fair growth. It is noted in this connection that both the oils were prepared in India and were probably not highly refined.

Six samples of native lentils, including two varieties of *Phascolus mungo*, *P. radiatus*, *Cicer arctinum* (two varieties), and *Cajanus indicus* furnished sufficient vitamin B in 1-gm. daily amounts to restore growth in rats on diets deficient only in this vitamin. Crude attah (a mixture of wheat, pea, and corn flour containing the husk of the cereals) and pure unbleached Indian flour also brought about resumption of growth when fed in 1-gm. amounts, supplementing the basal vitamin B deficient ration. White flour proved deficient in vitamin B.

Observations on the distribution of fat-soluble vitamins in marine animals and plants, J. HJORT (*Roy. Soc. [London], Proc., Ser. B*, 93 (1922), No. B 654, pp. 440-449, pl. 1, figs. 13).—Attention is called to previous observations that the growth of fish in Norwegian waters is almost entirely confined to the spring and summer months, and that this rapid increase in growth is accompanied by a decided increase in the supply of fat. In the herring the fat is deposited in a special peritoneal fat organ and in the cod in the liver. With a view to determining whether this change in growth, particularly in the amount of fat, is connected with the availability of certain kinds of food, pre-

liminary studies have been made of the content of vitamin A in green algae, diatoms, shrimps, and prawns, and also in cod and herring. The material to be tested was administered to rats as the sole source of vitamin A, either in the dried state or in the form of the oil extracted from the material by benzene and acetone and subsequently taken up in olive oil. The oil was administered from a pipette in a counted number of drops.

Fresh seaweed, *Ulva lactuca*, when kept in cold storage brought about an increase in the growth of rats if administered in 1-gm. amounts. The same weight of dried seaweed caused a more pronounced increase in growth. The extracted oil in amounts equivalent to 54 mg. daily also caused a marked increase in growth.

Rats fed on dried diatoms, 0.8 gm. daily, showed at first a sharp increase in growth, followed by a decline. The oil in the same amounts as that of the seaweed gave a marked increase in growth. It is suggested that the decline on the dried material may be due to the high content of silica in the diatoms. Fresh shrimps and prawns ad libitum caused a marked increase in the weight of the rats, but the extracted oil was without effect. Herring oil proved rich in vitamin A, as did also fresh and dried cod roe. Two gm. of the fresh roe and 1 gm. of the dried proved sufficient to cause rapid growth. The fact that the commercially dried roe proved as efficient as a source of vitamin A as fresh roe is considered of significance on account of the extensive practice of drying fish and fish products.

These observations are thought to indicate that vitamin A originates in sea plants in a similar way to that in land plants, and that marine animals obtain these vitamins directly or indirectly from the plants.

Vitamins and the future of margarin manufacture, C. FUNK (*Chem. Age [New York]*, 30 (1922), No. 5, pp. 227-230).—In this lecture, delivered before the Institute of Margarin Manufacturers, the author discusses the food value of oleomargarin as compared with butter, presenting evidence from the literature that margarin differs from butter from a nutritional standpoint chiefly in its diminished content of vitamin A. The suggestion is made that this difference may be partially eliminated by a better selection of raw materials and the use of methods of manufacture which will not be destructive of vitamin A, or entirely eliminated by the incorporation into the product of a small amount of cod liver oil.

Vitamins, II—V (*Biochem. Ztschr.*, 126 (1922), No. 5-6, pp. 189-280, figs. 83).—In continuation of the series previously noted (*E. S. R.*, 46, p. 204) four papers are presented.

II. *The acceleration of fermentation by extracts of animal organs*, S. Fränkel and J. Hager (pp. 189-226).—The results are reported of an examination by the method outlined in the first paper of the relative fermentation-accelerating power of different animal organs and tissues. The extracts were prepared by freeing the organs from blood and fat and extracting them with 80 per cent alcohol. The yellowish extract thus obtained was evaporated in vacuo at a low temperature, the aqueous solution remaining shaken with ether in a shaking machine to extract the dissolved fat, heated on a water bath to evaporate the alcohol and ether, and the extract made up to 50 cc. Ten cc. of this extract was used to determine its content of organic matter and 1 cc. for testing the fermenting power. The results obtained have been calculated in two ways, first, as the volume of CO₂ obtained from 0.1 gm. of extract and second, the volume of CO₂ from 100 gm. of the original material. The values thus obtained are, respectively, as follows: Anterior pituitary gland, dried, 1.87 and 92.18 cc.; posterior pituitary gland, dried, 1.94 and 106.4; hog muscle 3.72 and 61.73; egg

white 3.83 and 30.09; ovaries 5.42 and 42.25; pancreas 6.03 and 53.57; liver 6.54 and 119.2; sweetbreads 6.87 and 107.5; thyroid 7.02 and 55.28; bones 7.41 and 10.39; calves' brains 7.47 and 112; testicles 7.56 and 90.33; heart muscle 7.71 and 140.7; spinal cord 8.17 and 83.41; adrenals 8.2 and 97.25; thymus secretion 9.07 and 70.67; egg yolk 9.28 and 40.14; secretion of the large intestine 9.66 and 104; beef muscle 9.87 and 139; gastric juice 10.09 and 65.78; cerebrum (gray) 10.22 and 168.6; lungs 10.66 and 86.35; cerebellum (white) 10.62 and 186.5; kidney 14.36 and 211.5; secretion of the small intestine 14.88 and 122.8; and cerebellum (gray) 22.39 and 408.9 cc. The extract of bone marrow caused no acceleration of fermentation.

III. *The fermentation-accelerating extracts of plants and the action of cholin and amino ethyl alcohol on fermentation*, S. Fränkel and A. Scharf (pp. 227-264). A similar study to the above was made with fresh green vegetables, legumes, root vegetables, and unroasted and roasted coffee beans. The vegetables in general were tested in the fresh state after being ground and extracted with alcohol as described for the animal extracts. The results obtained, calculated on the basis of 0.1 gm. of the extract and 100 gm. of the original material, were, respectively, as follows: White flour, 1.12 and 1.5 cc., carrots 1.12 and 8.7 whole wheat flour 1.54 and 4.08, radish 1.57 and 19.25, roasted coffee 1.65 and 47.56, onions 1.67 and 67.5, leeks 1.71 and 31.51, garlic 1.85 and 15.07, corn germ 1.86 and 26.3, green coffee 1.86 and 19.78, chives 1.93 and 131.14, cabbage 2.03 and 48.05, lentils 2.28 and 6.11, peas 2.3 and 19.02, kohlrabi 2.95 and 57.28, potatoes 2.97 and 23.26, cooked lettuce 3.04 and 20.26, corn 3.23 and 12.07, beans 4.32 and 27.9, parsley 4.33 and 65.91, spinach 4.47 and 55.9, head lettuce 4.76 and 35.67, and celery 10.19 and 37.7 cc. In comparison with these figures, the values obtained for yeast were 7.74 and 39.34, respectively.

These results show in general that legumes and root vegetables have the weakest, green leaves a stronger, and alliaceous plants the strongest action.

Cholin and cholamin, β -amino ethyl alcohol, had an inhibiting effect.

IV. *Experiments on the adsorption of vitamins*, S. Fränkel and A. Scharf (pp. 265-268).—The relative adsorptive capacity of fuller's earth, kaolin, and aluminum hydroxid for vitamin B was tested by determining the fermentation-accelerating power of a given amount of yeast extract before and after shaking for a given length of time with equal weights of the three adsorbents. As tested in this way, fuller's earth appeared to adsorb the vitamins to a considerable extent, kaolin completely, and aluminum hydroxid not at all, thus indicating that the vitamin has basic properties.

V. *Further experiments on the chemistry of the vitamins*, S. Fränkel and A. Scharf (pp. 269-280).—Further attempts at isolating vitamin B are reported. The foundation material first employed was a commercial rice bran extract, Orypan. This was dissolved in water, treated with basic lead acetate to complete precipitation, allowed to stand for 24 hours, and then filtered. The filtrate was treated with hydrogen sulphid to precipitate the excess lead, filtered, the hydrogen sulphid expelled with carbon dioxide, and the solution concentrated in vacuo to 100 cc. The concentrated solution was treated with a concentrated alcoholic mercuric chlorid solution, left several days in the dark, filtered, and the precipitate washed with more of the mercuric chlorid solution. The mercury was removed from the filtrate with hydrogen sulphid, the solution neutralized with lead carbonate, the remaining lead precipitated with hydrogen sulphid, and the last of the hydrochloric acid removed with silver carbonate. Hydrogen sulphid was again added to remove completely any traces of metal, and the excess removed by carbon dioxide. The neutral filtrate was tested for activity by the fermentation test and gave a strong

inhibiting reaction. The mercuric chlorid precipitate was suspended in water and hydrogen sulphid passed through. The mercuric sulphid formed was filtered, washed well, and the hydrogen sulphid removed from the filtrate with carbon dioxid. The filtrate was neutralized with lead carbonate, the resulting lead chlorid filtered off, and the filtrate evaporated in vacuo in a current of hydrogen. Hydrogen sulphid was again added to remove the rest of the lead, and the excess removed as before. Silver carbonate was then added to the solution until Congo paper no longer turned blue. After filtering, the filtrate was again treated with hydrogen sulphid to remove the last traces of metal, and excess hydrogen sulphid removed as before. A part of this liquid was made alkaline with sodium bicarbonate and shaken with several successive portions of amyl alcohol. The amyl alcohol fraction was shaken with several portions of hydrochloric acid to remove the base.

Both the amyl alcohol solution and the hydrochloric acid water solution contained a carbohydrate which did not reduce Fehling's solution until after hydrolysis with hydrochloric acid. The nonhydrolyzed solution gave with α -naphthol and concentrated sulphuric acid the Molisch reaction, but did not give the orcin reaction for pentoses. The hydrolyzed solution gave, on warming with p-nitrophenylhydrazin, a noncrystalline precipitate. When a portion was decomposed with absolute alcohol an inorganic residue was left. The sirup was evaporated in vacuo in a current of hydrogen with the formation of inorganic crystals. The absolute alcohol filtrate was treated with an excess of alcoholic platinum chlorid and allowed to stand over night. The crystalline precipitate which formed was recrystallized from water, and on drying at 110° C. gave an elementary analysis corresponding to cholin platinate (C_6H_7NOCl), $PtCl_4$. The filtrate was too small to test for activity. It is considered of significance that in early vitamin work Suzuki, using a different method of isolation, had arrived at the conclusion that the antineuritic vitamin is a compound of cholin, dextrose, and nicotinic acid.

A second attempt to isolate the antineuritic vitamin was made along the same lines, using pressed yeast as a starting point. The crystalline platinum precipitate again proved to be identical with cholin platinate and to be inactive. The filtrate freed from platinum with hydrogen sulphid and from hydrochloric acid with carbon dioxid proved very reactive, but on evaporation crystals were formed which were inactive. On treating the alcohol solution with ether, a fraction separated which was inactive, but a drop of the remaining sirup proved active. The small amount of sirup was dissolved in water and precipitated with aqueous mercuric chlorid. After a few days a precipitate formed which was too small in amount to be analyzed, but which proved to be active.

On repeating the entire process with a large amount, 5 kg. of fresh yeast, enough of the precipitate was formed to make a micronitrogen analysis. The substance contained 4.75 per cent of nitrogen and gave no carbohydrate reaction with the Molisch reagent. This is thought to indicate that the vitamin is not a glucosid.

Vitamins, VI, U. SAMMARTINO (*Biochem. Ztschr.*, 125 (1921), No. 1-4, pp. 25-45, figs. 23).—Preliminary experiments having shown that vitamin [B?] accelerates zymase action, its effect on other enzymes has been studied.

The vitamin solution was found to have no appreciable effect on the activity of pepsin, trypsin, or taka diastase. Experiments with catalase showed that in alkaline solution the vitamin appeared to stimulate and in acid solution to retard catalase action.

Evidence of pancreatic disorder in rickets, E. C. DODDS (*Brit. Med. Jour.*, No. 3196 (1922), pp. 511, 512).—Evidence is presented of a decided increase in the diastatic power of the urine in cases of active rickets, followed by a decrease to normal during convalescence. There was also noted an increase in the fat content of the feces during active rickets. As the result of these findings, the author advances the theory that a pancreatic lesion is involved in rickets, and that this would result in a low production of fatty acids and a poor absorption of calcium.

Use of the carbon arc light in the prevention and cure of rickets, A. F. HESS and L. J. UNGER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 21, pp. 1596–1598).—The white flame carbon arc lamp has proved to be very effective in the treatment of infantile rickets and in the prevention of rickets in rats. The carbon lamp was similar to but smaller than those employed in taking motion pictures, and utilized a current of 30 amperes and 110 volts. A coarse mesh wire screen was placed in front of the lamp. The infants, entirely naked but with their eyes protected from the light, were exposed for one-half hour at a distance of 3 ft. or for one or two hours at a distance of 9 feet.

As shown by clinical X-ray and chemical examinations repeated at least every month, this treatment resulted in a rapid subsidence of the signs of rickets, accompanied by a constant increase in the inorganic phosphate of the blood. Of interest in this connection is the observation that while attempts to cure infantile rickets by rather large doses of secondary potassium phosphate (K_2HPO_4) in addition to the ordinary diet were unsuccessful, there were prompt and definite evidences of cure when the carbon light therapy was substituted for the phosphate, the cure apparently being hastened in some cases by the previous administration of phosphate.

It is pointed out in conclusion that the carbon arc lamp has advantages over the mercury vapor quartz lamp in the treatment of rickets in that it is comparatively inexpensive and its rays are nonirritating to the skin. It is suggested that in rickets clinics or in child-caring institutions such lamps may prove serviceable during the winter and spring months for protective therapy for groups of children.

The effect of cooling power of the atmosphere on body metabolism, J. A. CAMPBELL, D. HARGOOD-ASH, and L. HILL (*Jour. Physiol.*, 55 (1921), No. 3–4, pp. 259–264).—Experiments conducted upon two subjects to show the effects of out-of-door and indoor conditions upon metabolism are reported briefly. The metabolism was calculated by indirect calorimetry after the subject had been sitting quietly for half an hour in a room under ordinary conditions and out-of-doors at temperatures such as to give high cooling without causing shivering. The data obtained indicate that the basal metabolism is raised by cool out-of-door conditions.

Observations on metabolism: Research at the seaside, L. HILL and J. A. CAMPBELL (*Lancet [London]*, 1922, I, No. 14, pp. 675, 676).—Data are given on the resting metabolism of four subjects from 2 to 4 hours after breakfast and after sitting quietly for half an hour in the open air or in a shed, and of the metabolism of the same subjects walking along the shore, paddling, and bathing.

The figures for the resting metabolism of these subjects proved to be on an average 34 per cent above the basal metabolism measured in a closed calorimeter, and the figures obtained while bathing were 5, 6, and 7 times as high as the resting metabolism. The metabolism during paddling was higher than that during walking the same distance at the same speed, and that of walking heavily clothed was much higher than that of walking in a bathing suit.

Metabolism of children undergoing open air treatment, heliotherapy and balneotherapy, L. HILL and J. A. CAMPBELL (*Brit. Med. Jour.*, No. 3191

(1922), pp. 301-303).—The metabolism studies reported in this paper were conducted by the Douglas-Haldane method of indirect calorimetry on children crippled with surgical tuberculosis and undergoing open air treatment with direct exposure to the sun (heliotherapy) and in some cases balneotherapy, immersion in the sea.

Children who had been under treatment for many months showed a basal metabolism averaging 40 per cent higher than the Benedict-Talbot standards for children of the same weight (E. S. R., 45, p. 561). It is considered of significance that those who pigmented well gave about the same values as those who did not pigment well. This is thought to indicate that the rise in metabolism was due more to exposure to the open air than to heliotherapy as such. That open air conditions are responsible for higher metabolism is indicated further by the fact that children on admission to the hospital and lying in well ventilated cubicles gave results about 20 per cent higher than basal standards for closed calorimeters.

Balneotherapy was found to increase the metabolism much above the resting level.

A comparison of results obtained with the same subject in summer and in winter under ordinary conditions of open air treatment showed that the winter results were on the whole higher than those obtained in the summer. The metabolism of the same subjects placed in a warm room at about 70° F. was in all cases decreased, but was still above the basal standards of Benedict and Talbot.

Observations on the resting metabolism of children and adults in Switzerland. L. HILL, J. A. CAMPBELL, and B. HUDSON (*Brit. Med. Jour.*, No. 3193 (1922), pp. 385, 386).—Further evidence that exposure to the cooling power of the atmosphere results in an increase in metabolism is furnished in data obtained on the metabolism of children with surgical tuberculosis and of adults, some of whom were healthy and others suffering from tuberculosis exposed to a greater or less extent to the winter atmosphere in Switzerland. The observations were made by the Douglas-Haldane method of indirect calorimetry after a light breakfast.

The metabolism of the children was from 50 to 225 per cent above the basal standards of Benedict and Talbot for children of the same weight (E. S. R., 45, p. 56). In the case of the adults, assuming as standards a basal metabolism of 40 calories per square meter per hour for men and 35 for women, the metabolism was from 38 to 79 per cent above the normal.

The authors conclude that those cases will benefit from exposure which can respond to it by adequate increased metabolism and digestion and absorption of food.

Tables, factors, and formulas for computing respiratory exchange and biological transformations of energy. T. M. CARPENTER (*Carnegie Inst. Wash. Pub.* 303 (1921), pp. 123, fig. 1).—This publication consists of a collection from various sources of tables and conversion factors needed in calculating results from measurements obtained by several types of respiratory exchange apparatus, particularly the Regnault-Reiset and the combination of spirometer valves and breathing appliance, and of formulas and tables for predicting basal metabolism at all ages. A section giving the method of construction and calculation of the tables precedes the tables themselves.

ANIMAL PRODUCTION.

Introduction to heredity. R. GOLDSCHMIDT (*Einführung in die Vererbungs Wissenschaft. Leipzig: Wilhelm Engelmann, 1920, 3. ed., rev. and enl., pp. XII+519, figs. 178*).—In this, the third edition of the book previously noted

(E. S. R., 31, p. 406). the results of the more recent studies in heredity have been added.

A peculiar mode of inheritance and its cytological explanation, Ö WINGE (*Compt. Rend. Lab. Carlsberg*, 14 (1922), No. 17, pp. 10, pl. 1 figs. 2).—The results are given of cytological investigations made in studying the method of inheritance of the black spot on the dorsal fin of *Lebistes reticulatus* reported by Schmidt (E. S. R., 45, p. 370). Spermatogenesis and oogenesis are described as they were found to occur in this fish. In spermatogenesis at the reduction division of the primary spermatocyte the chromosomes appear very clearly, being 23 in number and regularly placed, with 13 around the outside and 10 inside of the clump. All were oval and of practically the same shape. In the case of the female it was more difficult to count the chromosomes, but 46 seemed to be the somatic number, indicating that the number of chromosomes is the same in both males and females. Limitations are suggested for the use of the terms "sex limited" and "sex linked" inheritance, and "one sided masculine" inheritance is suggested as applying to the type described by Schmidt in *Lebistes*.

Dice casting and pedigree selection.—Experiments which picture mathematically close analogies between dice casting and certain breeding phenomena, H. H. LAUGHLIN (*Genetics*, 6 (1921), No. 4, pp. 384-398, figs. 3).—This is a discussion of the similarity which exists between dice casting and certain phases of actual breeding. Tables are presented showing biometrical studies of dice-casting experiments.

Current maps of the location of the mutant genes of *Drosophila melanogaster*, C. B. BRIDGES (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 4, pp. 127-132).—The author presents a revised map of the chromosomes of *D. melanogaster* showing the location of the mutant genes, which is much more complete than any map which has been previously published.

A further report on species crosses in birds, J. C. PHILLIPS (*Genetics*, 6 (1921), No. 4, pp. 366-383, figs. 5).—This is a report of the continuation of the experiments in crossing ducks and pheasants previously noted (E. S. R., 32, p. 869; 34, p. 564).

In mating the F_1 hybrids resulting from the mallard and Florida duck crosses the 38 F_2 males produced contained birds which very closely resembled the mallard and the Florida parents, with all gradations between and some mixed types. The F_2 females showed about the same variation as would be found among mallard females. Crossing F_1 's back to mallards produced 13 males, 10 of which resembled mallards except that the neck ring was not complete. The 23 females produced were in some respects nondistinguishable from pure mallards.

Of the 23 F_2 males obtained from mallard×black duck crosses, none seemed to approach either parental type as in the mallard×Florida ducks. In further experiments with so-called freak mallard and black duck crosses, it was found that freak females were not produced, perhaps due to lethal factors.

Sex linkage, as seemed possible in previous experiments with Gold and Lady Amherst pheasants, was completely disproved by further crosses and eight back crosses. Segregation in the F_2 males was in no case complete, but all birds showed some characters of each with little evidence of linkage. The sexes reported in these crosses and back crosses with pheasants showed 100 males to 131 females.

Crosses between Black Kalij and Silver pheasants produced intermediates in the F_1 generation, and the F_2 's varied from the F_1 to one which was almost all black.

Color of crossbred calves, J. J. HOOPER (*Jour. Heredity*, 12 (1921), No. 10, p. 480).—The offspring of five matings of a purebred Holstein bull with purebred or high grade Jersey cows at the Kentucky Experiment Station were of the following colors: Two all black, two black and white as Holstein, and one black body with white legs. Mating a grade black Holstein cow with a Jersey bull produced an all black calf.

Sex ratios in fetal cattle, F. M. JEWELL (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 41 (1921), No. 5, pp. 259–271, fig. 1).—In studying the sex ratios of fetal cattle, observations were made on 1,000 fetuses at a Chicago slaughterhouse as to the sex and the length of each fetus. By classifying them according to the variations in length of 10 cm., it was found possible to study the differences in the sex ratio according to the approximate age.

While there was some variation in the sex ratios of the different ages of fetuses, especially in the smaller populations, the data indicate that there is no greater mortality of one sex during the early development than in the other, since the sex ratio of 123.21 as determined for the total was rather closely maintained throughout. Data collected from breeders on 1,767 Shorthorn calves and 2,036 Holstein-Friesian calves showed, respectively, sex ratios of 97.87 and 97.66. The difference between these ratios and the ratio of 123.21, as obtained on the fetuses, is thought to be due to breeders not reporting both sexes alike or to errors in sampling, and not to any greater mortality of one sex during fetal life.

[Nutritive value of cereal hays, root crops, and some California grasses] (*California Sta. Rpt. 1921*, pp. 36, 37, 39, 48, 49).—In cooperative work between the divisions of agronomy and nutrition, analyses of the nutrients are reported for rye, wheat, oat, and barley hays for the entire hay and for the leaves, heads, and culms, as well as for the following root crops: Danish Sludstrup, Colossal Red, Yellow Intermediate, and Giant Yellow Intermediate mangels; Kentville swedes; Danish Champion and White Belgium carrots; Giant Half-Sugar beets; and Golden Tankard stock beet.

Analyses of the feeding value of the following grasses, as determined by M. E. Jaffa and H. Goss, are also reported: Fine leaf alfalfa (*Erodium cicutarium*), large leaf alfalfa (*E. moschatum*), Napier grass (*Pennisetum purpureum*), *Astragalus stipulatus*, *Solanum bullatum*, African millet (*Eleusine coracana*), St. Augustine grass (*Stenotaphrum americanum*), Kikuyu grass (*P. longistylum*), Para grass (*Panicum barbinode*), and smooth and hairy Napier grass grown under greenhouse conditions.

The dietetic value of cereals and their products, W. J. COLEBATCH (*So. Aust. Dept. Agr. Bul.* 155 (1921), pp. 16).—In this paper analyses are presented of the wheat, oat, barley, and rye plants cut at different stages of growth, and their relative values as green forage, silage, hay, grain, by-products, straw, and chaff are discussed.

The nutritive value of the sunflower plant (*California Sta. Rpt. 1921*, pp. 37, 38).—An analyses of the sunflower plant fully matured by the division of nutrition showed water 78 per cent, protein 2.94, fat 1.6, crude fiber 7.61, nitrogen-free extract 7.98, and ash 1.87 per cent.

[Feeding stuffs analyses in Florida], R. E. ROSE (*Fla. Dept. Agr. Quart. Bul.*, 32 (1922), No. 2, pp. 181–186, 201–217).—This report of the Florida State chemist includes tables showing the values of protein, fat, and carbohydrates in feeding stuffs, the average composition of feeding stuffs, and analyses of samples of the following sold in the State: Cottonseed meal, velvet bean feed, wheat bran and screenings, gray wheat shorts, wheat shorts with ground screenings, unhulled peanut oil feed, and various proprietary stock and poultry feeds.

Beef cattle range experiment (*California Sta. Rpt. 1921, pp. 124, 125*).—Efforts by G. H. True and G. H. Wilson to determine the most economical age to market steers and studies of the amount of hay necessary to winter range cattle are reported. It was concluded that cattlemen could well afford to feed range cattle more liberally during the winter. Twenty-five calves, after weaning, were placed on alfalfa pasture from December 14 to April 14, during which time they made an average daily gain of 2.2 lbs. per head.

The feeding of dry-farm crops to range steers in eastern New Mexico, J. L. LANTOW and H. J. CLEMMER (*New Mexico Sta. Bul. 131 (1922), pp. 10, figs. 3*).—To determine the value of home-grown New Mexico feeds for range steers a 110-day feeding experiment, beginning November 11, 1921, was carried on by the animal husbandry department of the station in cooperation with the Office of the Dry-Land Agriculture, U. S. D. A., in which two lots of 15 yearling steers each were fed in open lots, protected only by windbreaks of buildings and trees on the north and east. Lot 1 received a ration of ground milo grain, sumac sorghum fodder, and cottonseed meal, whereas the ration for lot 2 was composed of ground milo, kafir silage, and cowpea hay.

The summary of the data collected from the experiment appears in the table below, which shows the average weights of the steers in each lot, the average daily gains, the average daily rations, and the number of pounds of pork produced by 6 hogs following the steers in lot 2 and 11 in lot 1. Eight of these hogs, however, were added close to the end of the test. The hogs received no extra feeds.

Summary of 110-day steer feeding test.

Lot	Average initial live weight of steers	Average daily gain of steers	Average daily ration					Gain of hogs.
			Ground milo.	Cotton-seed meal	Sumac sorghum fodder	Cowpea hay	Kafir silage.	
	Pounds.	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds.	Pounds.
1	565.7	2.03	11.2	1.6	11.5			250
2	598.6	2.02	12.8			5.2	15.7	329

From the results of the test, the authors conclude that steers furnish an efficient method of disposing of surplus fodder and grain raised in good years in the dry-land sections of New Mexico. Sumac, sorghum fodder, and cowpea hay were found to be satisfactory feeds for steers in a properly balanced ration.

Data on the yields of varieties of sorghum, corn, and cowpea hay are given, most of which have been previously noted (*E. S. R., 47, p. 333*).

Shorthorn breeders' guide, 1921 (*London: Shorthorn Soc., [1921], pp. 197, pls. 4, figs. 200*).—In this edition of the Shorthorn breeders' guide for 1920-21, several articles are included of special interest to Shorthorn breeders and showmen, most important of which is a Short History of the Breed, by R. Bruce.

[Cattle and sheep breeding in India] (*India [Dept. Agr.] Rev. Operations, 1920-21, pp. 69-75*).—An account is given of the cattle and sheep breeding operations in different sections of India.

Sheep breeding (*California Sta. Rpt. 1921, p. 133*).—In studies by J. F. Wilson, records on 105 Rambouillet, Hampshire, Shropshire, Southdown, and Romney ewes showed the average gestation period of single lambs to be 148.04 days, twin lambs 147.2 days, and triplets 145.3 days. Of the lambs

dropped, 47.39 per cent were singles, 5.57 per cent were twin rams, 13.74 per cent were twin ewes, and 28.57 per cent were twin sibs (ewe and ram).

Mendellism in fur sheep crosses, R. W. DUCK (*Jour. Heredity*, 12 (1921), No. 9, pp. 410-413, figs. 2).—The results of Karakul sheep breeding by F. E. Dawley, of Fayetteville, N. Y., from 1912 to 1920 are reported. The black color, curl, density, and luster of the fleece as possessed by Karakul sheep were found to behave in crosses with other breeds as dominant Mendelian characters. An outstanding peculiarity, however, in the results was the appearance of a red sheep.

Texas Station to undertake determination of wool shrinkages, J. M. JONES (*Natl. Wool Grower*, 12 (1922), No. 4, pp. 17, 18, fig. 1).—It is noted that a wool scouring plant has been established at the Texas Experiment Station to make determinations on the shrinkage of wool during scouring.

Annual wool review, 1921 (Boston: *Natl. Assoc. Wool Manfrs.*, 1922, pp. 105-220, pls. 5, figs. 5).—This is the thirty-third annual wool review issued by the National Association of Wool Manufacturers, of which the review for 1920 was previously noted (*E. S. R.*, 45, p. 69). The important events in the American wool industry in 1921 are discussed, as well as the estimated wool production by States and by countries, the imports and exports and wool on hand, and the comparative prices at different markets. Tables are also presented showing the number of sheep in the different countries and the numbers slaughtered at 10 different markets in the United States.

The wool yearbook, 1922 (London: *Marsden & Co., Ltd.*, 1922, 14. ed., pp. [V]+615, figs. 160).—This volume deals mainly with the manufacturing of wool, but also includes discussions of statistics on the world's wool supply and markets, as well as a 43-page glossary of wool fabrics and textile terms.

The water buffalo, H. P. GARLAND (*Saco, Me.: Garland Manfr. Co.*, 1922, pp. 51, figs. 38).—This book gives a description of the characteristics and habits of the water buffalo, explaining its uses as a beast of burden and for milk production. The main purpose of the work, however, is to describe the manufacture of loom pickers from water-buffalo hides.

The northern pig from birth to market, J. H. SHEPPERD (*North Dakota Sta. Bul.* 156 (1922), pp. 28, figs. 11).—The general principles of handling and feeding pigs from farrowing to marketing time is discussed in a popular manner, with special reference to the methods employed at the station. The results of a test with three lots of 30 pigs averaging from 40 to 50 lbs. at the start of a 100-day feeding trial on alfalfa pasture and of a trial in hogging down corn with two lots of 48 pigs for 57 days are also reported.

In the trial on alfalfa pasture, which began on May 19, 1921, 1 acre was allowed each lot, with a grain ration of 60 parts of corn and 40 parts of shorts. In lots 1 and 2 the grain was fed at the rate of $2\frac{1}{2}$ and $3\frac{1}{2}$ lbs., respectively, per day per 100 lbs. of live weight, and in lot 3 the grain was self-fed. The average daily gains were, respectively, 0.78, 0.93, and 1.14 lbs., and the grain consumed per 100 lbs. of gain was 325, 344, and 464 lbs., respectively. The greatest profit was calculated as coming from lot 2.

In the trial in hogging down corn, which began on August 19, 1921, each lot was allowed 11.8 acres of standing corn, with a calculated yield of 28.34 bu. per acre, supplemented in lot 2 with tankage in a self-feeder. One hundred and sixty-five pounds of shorts was fed each lot during the first few days on corn. The pigs in lot 1 receiving no tankage and averaging 129.5 lbs. in weight at the start made average daily gains of 1.41 lbs., as compared with daily gains of 1.71 lbs. with the pigs in lot 2 which averaged 128.1 lbs. in weight at the start of the test. The pigs in lot 1 consumed 4.88 lbs. of corn grain and shorts per

pound of gain, whereas the pigs in lot 2 consumed 4.04 lbs. of corn grain and shorts and 0.46 lb. of tankage per pound of gain. The cost of tankage was so high that the pigs receiving the tankage supplement, notwithstanding the fact that they made better daily gains, did not make as great a profit as those in lot 1, though the ration for the pigs in lot 1 evidently was lacking in some substance, since these pigs did a great deal of rooting, which was not evidenced in lot 2.

Pig raising where lucern can be successfully grown in South Australia, W. J. SPAFFORD (*So Aust. Dept. Agr. Bul. 149 (1920), pp. 16, figs. 8*).—This bulletin includes general instructions for pig raising in South Australia, dealing with the choice of breeds, methods of feeding, management, breeding, and marketing of hogs.

The value of palm nut meal for fattening pigs (*Ireland Dept. Agr. and Tech. Instr. Jour., 21 (1921), No. 3, pp. 306-309*).—Experiments in feeding oil palm nut meal to fattening pigs at eight different centers are reported. The pigs in each place were divided into two lots. The lots numbered 1 were fed equal parts of corn meal and pollard (coarse wheat bran), whereas the lots numbered 2 were fed equal parts of corn meal, pollard, and oil palm nut meal. In all cases both lots were fed equal amounts of skim milk or buttermilk with potatoes or swedes in four of the experiments. For the feeding period of 94 days the average daily gain was found to be 1.624 lbs. for the lots numbered 1 and 1.620 lbs. for the lots numbered 2, or practically the same in both cases.

Individuality as a factor in fattening pigs (*California Sta. Rpt. 1921, p. 131*).—In an experiment conducted by E. E. Hughes 3 lots (number of pigs not stated) of purebred Poland-China pigs, averaging about 112.5 lbs. per head, individually fed in self-feeders on rations of whole barley, rolled barley, and rolled barley and tankage made average daily gains of 0.54 lb., 0.85, and 1.22 lbs., respectively. The results on individuality were not very definite and are not reported.

All about dogs, H. VIBERT (*Bound Brook, N. J.: Q-W Labs., 1921, pp. [91], figs. 9*).—General elementary instructions are given for training, breeding, and caring for dogs.

Twentieth century bird dog training and kennel management, E. M. SHELLEY, edited by A. F. HOCHWALT ([*Dauton, Ohio*], 1921, pp. 98, pls. 12).—This book gives general directions for training bird dogs, as well as hints on the general care of dogs in health and disease, and a description of what is called the twentieth century dog kennel.

Poorman's poultry guide, J. G. POORMAN (*Tinley Park, Ill.: Author, 1922, pp. 68, figs. 53*).—This work, which is profusely illustrated, especially with plans for poultry houses, gives general instructions for the poultry raiser.

Experiments in feeding laying hens, A. R. LEE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 7 (1921), No. 10, pp. 74-76*).—A popular report is given of some of the results obtained in 8 years' experiments by the U. S. Department of Agriculture in feeding laying hens. The mash found to give the best results was composed of 4 per cent bran, 4 per cent middlings, 26 per cent meat scrap, and 66 per cent corn meal. Fifteen per cent meat scrap in the mash seemed to be sufficient for yearling hens, but 20 to 25 per cent gave the best results with pullets. Yeast was not found to be of much value for the feeding of laying hens.

Marrow-stemmed kale for poultry, L. A. HUTCHINSON (*Jour. Min. Agr. [London], 29 (1922), No. 2, pp. 177, 178*).—The value of marrow-stemmed kale for winter feeding of poultry is described. It furnishes a ready source of

green food which is not injured by frost, as it is the marrow or pith which the poultry eat.

Preliminary note on the correlation between age at first laying, and size of first eggs in pullets, W. A. LIPPINCOTT (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1921), No. 10, pp. 73, 74).—The results of preliminary studies on the correlation between the age at first laying and the size of the first eggs of 123 Single Comb White Leghorn pullets are reported as determined at the Kansas Experiment Station. The class ranges for the egg weights were 0.01 lb. and for age were 50 days. A positive coefficient of correlation of 0.7139 ± 0.02035 was obtained between early laying and small eggs, indicating that too early laying of pullets is not desirable, due to the small size of the eggs produced.

Relation of egg weight to chick weight at hatching, D. L. HALBERSLEBEN and F. E. MUSSEHL (*Poultry Sci.*, 1 (1922), No. 4, pp. 143, 144).—In a study at the Nebraska Experiment Station the relation between the size of chicks and the size of eggs was studied, as well as the size of chicks from white and brown eggs.

The results on 352 chicks showed that the chick weight varied from 63 to 66 per cent of the egg weight, averaging 64 per cent. The size of the chicks thus varied directly with the size of the eggs, although weights at 35 days of age showed that the chicks from smaller eggs averaged as high in weight as the others. Chicks from brown eggs were found to be proportionately slightly heavier than chicks from white eggs.

The interrelationship of the egg records of various periods during the first and second year of the White Leghorn fowl, J. A. HARRIS and H. R. LEWIS (*Poultry Sci.*, 1 (1922), No. 4, pp. 97-107, figs. 3).—A report is given of the correlation which has been found to exist between egg records of various periods of the year and the total year's production, during the first and second laying year, for 453 Single Comb White Leghorns entered in the first international egg-laying and breeding contest at Vineland, N. J., which was previously reported (*E. S. R.*, 43, p. 173).

Correlation tables and graphs are presented showing the correlation between the production during each month of the year and the total yearly egg production, and the production during the other 11 months for the first and second laying year. The regression of total annual production on monthly production in the second year is, roughly speaking, linear, as was determined previously for the first year (*E. S. R.*, 46, p. 575). Therefore the production for 1 month may be used with nearly as much accuracy for predicting the second year's egg production as for the first year's production.

[**The Santa Cruz Farm Bureau egg-laying contest**] (*California Sta. Rpt.* 1921, pp. 136-138).—The history of the establishment of this contest is set forth, and the results of the contest, which closed November 15, 1920, are given.

Texas national egg-laying contest, T. J. CONWAY (*Poultry Sci.*, 1 (1922), No. 4, pp. 129-133, fig. 1).—This is the report of the fourth Texas egg-laying contest from November 1, 1920, to October 30, 1921. Thirteen breeds were represented by 86 breeders. Tables are shown, giving the monthly production for all breeds and the feed consumed, together with the monthly rainfall, temperature, and mortality.

The second western Washington egg-laying contest, Mr. and Mrs. G. R. SHOUR (*Poultry Sci.*, 1 (1922), No. 4, pp. 136-142).—A complete report of the second western Washington egg-laying contest is given. Thirteen different breeds were represented by 79 pens of 6 birds each. Tables are also furnished showing the feed consumed per bird.

Canadian egg-laying contests (*Poultry Sci.*, 1 (1922), No. 4, pp. 134-136).—The results are tabulated from the final reports of the Canadian, Nova Scotia, Saskatchewan, New Brunswick, British Columbia, Alberta, Ontario, Manitoba, Quebec, and Prince Edward egg-laying contests.

Egg records for the year 1920-21 (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1921), No. 3, pp. 336-347).—This article discusses the egg records kept during 1920-21 by the Department of Agriculture of Ireland on 70 flocks of different breeds and compares the averages with those of previous years.

Report on second egg-laying competition at New Town, Tasmania, 1919-20, W. A. BAGLEY (*Tasmania Dept. Agr. Bul.* 96 (1920), pp. 2).—A report of the second egg-laying contest at New Town, Tasmania, which ended April 4, 1920, is given. A total of 374 birds were entered in the competition.

What precision is worth while when weighing hens, L. E. CARD (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1920), No. 1, pp. 7, 8).—A discussion is given of the variation in weight which occurred in 49 Single Comb White Leghorn pullets which were weighed hourly from 8 a. m. to 6 p. m. on July 12, 1920. The average variation was not great, but individuals varied, due to laying eggs or consuming food and water.

The greening of poultry, M. E. PENNINGTON and C. M. SHERWOOD (*Poultry Sci.*, 1 (1922), No. 4, pp. 114-124).—Studies from the Bureau of Chemistry, U. S. D. A., are reported on the greening of poultry during storage. Thirteen birds were killed, and observations were made on the appearance of greening when they were chilled and held at different temperatures ranging from 32 to 98° F. Two other birds were killed, cooled to 45°, and stored at 55° in oxygen-free atmospheres, one being in carbon dioxide and the other in nitrogen. Since very little greening occurred in either of these birds in 14 days, but a great deal when oxygen was admitted, it was decided that the greening was due to the formation of sulphhemoglobin.

In bacterial studies cocci and bacilli were found in close relationship with the greening, but not in pure cultures. Organisms isolated from green-struck chickens which produced H₂S were found to produce greening at the point of infection in the skin of other fowls. Experiments with birds having the skin sterilized before storage indicated that the greening was due at first to H₂S formed by the bacteria in the intestine reaching the surface and the greening then occurring. Feeding just before killing was found to increase markedly the amount of greening.

Raising of turkeys under yard conditions (*California Sta. Rpt.* 1921, p. 138).—Favorable results are reported in raising Mammoth Bronze turkeys under yard conditions. The eggs had been hatched artificially and the poults reared in brooders. Over 50 per cent of the turkeys hatched were marketed.

Raising ducks and geese on New Jersey farms, W. C. THOMPSON (*New Jersey Sta. Hints to Poultrymen*, 10 (1922), No. 11, pp. 4, fig. 1).—This consists of a series of questions and answers on duck and goose farming, based on the inquiries which have come to the department of poultry husbandry during the past years.

DAIRY FARMING—DAIRYING.

[Experiments with dairy cattle of the California Station] (*California Sta. Rpt.* 1921, pp. 125, 126).—In continuing the studies by Woll (E. S. R., 44, p. 775), the third year's test of cereal hay for young dairy heifers was conducted from August to October, 1920, 24 yearling heifers being separated into 4 lots fed barley, wheat, oat, and rye hay, respectively. The average daily

gains per head were for wheat and rye hays 0.65 lb. each, barley hay 0.54 lb., and oat hay 0.16 lb.

Two lots of 9 cows each were used in the studies of the effect of coconut meal on milk production. During the periods when coconut meal was fed there was a slight increase in both milk and butter fat production, and the average quality of the milk was also improved.

Sunflower silage for dairy cattle, G. E. MORTON (*Colorado Sta. Rpt. 1921*, p. 16).—In continuing the experiments with sunflower silage for dairy cattle (E. S. R., 45, p. 274), the sunflowers yielded only 15.37 tons of silage per acre during 1921, due to a blight.

Blackstrap molasses for dairy cattle, E. BRENTNALL (*Mississippi Sta. Circ. 38 (1921)*, p. 4).—An account is given of a feeding test with two cows fed a ration containing blackstrap molasses for three weeks, while two other cows were fed a similar ration containing an equal amount of corn in place of the molasses. This feeding period was followed by a second three-week period in which the rations were reversed. The cows on the molasses ration produced 3,326.1 lbs. of milk containing 166 lbs. of fat, as compared with 3,314 lbs. of milk and 163.2 lbs. of fat produced by the cows in the corn ration. The conclusion to be drawn from the results is that corn and molasses, pound for pound, are practically equal in feeding value for milk production.

Fifteen calves from 3 to 6 months of age fed rations of equal parts of corn and oats and equal parts of molasses and oats with and without skim milk also indicated that molasses is at least equal to corn as a feed for dairy calves.

A discussion is also given of commercial mixed molasses feeds and methods of feeding molasses.

Calf rearing, J. C. BRUCE (*New Zeal. Jour. Agr.*, 22 (1921), No. 4, pp. 193-199, figs. 3).—In continuing the calf rearing tests previously noted (E. S. R., 43, p. 575), similar tests were carried on during 1920-21, at the Ruakura, Weraroa, and Moumahaki experimental farms. At each place 16 calves were divided into 4 lots as uniformly as possible, which were fed on different combinations of feeds. The 4 lots of calves at each place were all run on the same pasture with the same shelter so that they had the identical conditions except in the case of the feeding.

At the Ruakura Farm the lots were composed of 1 bull and 3 heifers of Shorthorn breeding. Each lot received 8 lbs. of whole milk per head per day for the first 2 weeks, and the following daily rations for lots 1 to 4 for the next 15 weeks: (1) eight oz. whole flaxseed, 2 oz. flour, and 15 lbs. of skim milk; (2) 1 lb. of crushed oats and 15 lbs. of skim milk; (3) 9 oz. of crushed flaxseed and 15 lbs. of hay tea (1 lb. of lucern hay to 1½ gal. of water); and (4) 9 oz. of crushed flaxseed and 15 lbs. of skim milk.

The calves used at the Weraroa Farm consisted of Shorthorn, Jersey, Friesian, Hereford, and Guernsey crosses. The following daily rations per calf were fed in the different lots: (1) Eight lbs. of whole milk for 2 weeks, 16 lbs. of skim milk for 2 weeks, 4 oz. of pea meal, and 6 oz. of linseed meal for 14 weeks; (2) 8 lbs. of whole milk for 2 weeks, 16 lbs. of skim milk for 2 weeks, 4 oz. of bran, and 1 lb. of crushed oats for 14 weeks; (3) 8 lbs. of whole milk for 2 weeks, 16 lbs. of skim milk for 16 weeks, and 1 qt. of flaxseed gruel (1 lb. of flaxseed and 1 gal. of water) for 14 weeks; and (4) 8 lbs. whole milk for 1 week, 16 lbs. of skim milk for 1 week, 8 oz. bean meal, and 6 oz. cooked linseed meal with 3 qt. of warm water for 16 weeks.

At the Moumahaki Farm the calves were mainly Shorthorns though they showed traces of Jersey blood. The daily rations per head were as follows in the different lots: (1) Eight lbs. of whole milk for 2 weeks, 8 lbs. of skim milk for 2 weeks, 3½ oz. of bean meal, and 2½ oz. of ground flaxseed for 13

weeks; (2) 8 lbs. of whole milk for 2 weeks, 8 lbs. of skim milk for 2 weeks, 3 oz. of corn meal, and 3 oz. of ground flaxseed for 13 weeks; (3) 8 lbs. of whole milk for 2 weeks, 8 lbs. of skim milk for 2 weeks, 3 oz. of oatmeal, and 3 oz. of flaxseed meal for 13 weeks; and (4) 8 lbs. of whole milk for 10 days, 8 lbs. of skim milk for 11 days, 1 oz. of linseed meal for 14 weeks, with 1 oz. of crushed oats for 4 weeks, and 3 oz. of crushed oats for 10 weeks. The feeds were prepared differently, the meals and flaxseed being mainly soaked or cooked, whereas the other feeds were mostly stirred into the skim milk just before feeding or fed dry. The value of the substances fed is best observed in the following table:

Weights, gains, and cost of feeding calves on different rations.

Place of test	Lot number	Total initial weight	Total final weight	Total gain	Average daily gain per head	Cost of food per head
		Pounds	Pounds	Pounds	Pounds	£ s d
Reakuta	1	374	1,234	920	1.93	2 3 11
	2	376	1,340	974	2.04	2 1 13
	3	369	1,141	772	1.62	1 16 9
	4	363	1,237	874	1.83	2 3 31
Weinroa	1	367	718	351	.81	1 8 81
	2	264	640	376	.78	1 10 101
	3	269	833	565	1.12	1 13 7
	4	1,224	1,571	1,347	.92	1 9 6
Mounahaka	1	208	723	515	1.12	19 3
	2	226	700	474	.88	19 11
	3	303	578	275	.61	1 3 51
	4	318	794	476	1.04	12 11

¹ Three calves

Analysis of dairy records, F. T. RIDDLE and S. J. BROWNELL (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 120, 121).—The summaries of cost accounts kept on 14 herds of dairy cattle in Michigan indicated that the largest net returns were produced by the best managed herds.

The college dairy herd, J. O. TRETSVEN (*Montana Sta. Bul.* 145 (1921), pp. 24, figs. 8).—The development at the station of the purebred Holstein and Jersey herds which originated from purchases in 1907 and 1908 is described. Practically all the present Holstein herd has descended from one cow purchased in 1908, with a few individuals which are descendants from a second cow. Five bulls have been purchased and used in the improvement of this herd. In case of the Jersey herd 13 of the 20 head now on the farm have descended from two original cows. The development of the Jersey herd was much impaired by the use of bulls during the first few years which were no better than the cows.

A discussion is given of the methods of care, management, and feeding of the dairy herd, young stock, and calves, as well as an explanation of the records which are kept of the cattle.

The improvement of quality in milk through the efforts of college extension service, J. D. BREW (*Abstr. in Abstr. Bact.*, 6 (1922), No. 1, p. 18).—The author presented a paper before the Society of American Bacteriologists in which results which have been obtained in lowering the bacterial counts in milk in New York State through the efforts of the State college extension force are given.

Investigations of the effects on the milk secretion of cows produced by the injection of their own milk, DIERKS (*Monatsh. Prakt. Tierheilk.*, 33 (1922), No. 1-3, pp. 25-47).—After a discussion of similar experimental work, mainly with women, the author describes the results of subcutaneous injections of from 20

to 30 cc. doses of milk into the neck of cows aseptically drawn from the animal in which it was injected. The cows selected for the experiments varied in age and period of lactation. In some cases the milk flow was increased and in others decreased after the injections, but the author concludes that certain positive results showing an increase in the milk production were not obtained in any case with the first injection. In some cases slight positive increases were obtained with the second injection about 11 days after the first.

A study of cattle which held back their milk. O. ZIETZSCHMANN (*Latt.* 2 (1922), No. 4, pp. 229-237).—After giving a brief review of the physiology of milk secretion, the author describes the case of an animal which frequently held back its milk, especially when excited. The conclusions as to the cause of this were stated as being an involuntary excitement of the muscles of the teats, which, acting on the sympathetic system of the animal, tended to interfere with the action of the secretory cells of the udder, and thus the milk was not secreted as rapidly as normally during milking.

[**Experimental work in the dairy industry at the California Station**] (*California Sta. Rpt.* 1921, pp. 118-122, 123).—The results which have been obtained and the experiments performed by the division of dairy industry are noted.

Studies made by C. L. Roadhouse and J. C. Marquardt to determine if the bacterial content of milk could be controlled and if the cream in the milk was changed by agitation in a self-service milk dispensing machine indicated that the butter fat, bacterial content, and cream line remained practically constant for milk which was drawn from the machine during a period of 11½ hours.

Studies by Roadhouse on the temperature of the surface of heated milk not agitated showed that it was several degrees lower than the temperature of the milk 6 in. below the surface, indicating the importance of agitation during pasteurization.

Analyses by Marquardt of 124 samples of milk having bacterial counts of from 800 to 630,000 per cubic centimeter and ranging from 0.16 to 0.22 per cent in acidity indicated that there was no relation between the bacterial count and the percentage of acidity in the milk.

Trials by G. D. Turnbow in skimming goat's milk with a disk type and a tubular type separator resulted in cream containing 34 and 33 per cent fat, respectively, by the different separators and 0.015 per cent fat in the skim milk in both cases. When this cream was churned at 58° F. it produced butter which scored 90, slight deductions being made for flavor and body. The butter-milk was found to test 0.4 per cent fat, probably due to hand churning.

Analyses of goat's milk by M. E. Jaffa and H. Goss showed that the fat percentage varied from 3.25 to 7.2 per cent. The milk with the lower fat percentage was stated as being best adapted for infant feeding.

White fir and cottonwood were found to be practically as well adapted for butter-box material as spruce when lined with parchment paper.

Studies by Turnbow and Marquardt on the weight of a gallon of ice cream indicated that there was considerable variation in the weight of ice cream, seemingly due to various conditions which could not be explained.

Experiments in keeping milk fresh by the addition of small amounts of hydrogen peroxid. A. MÜLLER (*Milchw. Zentbl.*, 51 (1922), Nos. 3, pp. 25-29; 4, pp. 37-39; 5, pp. 49-53; 6, pp. 61-64).—Following a summary of the literature on the value of adding hydrogen peroxid to milk to increase its keeping qualities, the results of several laboratory and practical experiments are reported in which the length of time of keeping milk fresh was markedly increased. The best results were obtained by pasteurizing the milk for one-half hour at 70° C., after which it was cooled to 15 or 20° and from 0.08 to 0.15

per cent of H_2O_2 was added. This milk was found to keep several times as long as the pasteurized milk which contained no H_2O_2 . After about 24 hours it was impossible to distinguish the milk containing the hydrogen peroxid from fresh milk by taste, and the bacterial content did not increase as rapidly as in milk without the H_2O_2 .

The whipping quality of cream, C. J. BARCOCK (U. S. Dept. Agr. Bul. 1075 (1922), pp. 22, figs. 14).—Results of experiments were reported in which the time required to whip cream and the stiffness of the whipped product were recorded for raw, pasteurized, raw homogenized, and pasteurized-homogenized cream containing from 20 to 30 per cent of butter fat. In these experiments the cream was all whipped in a beaker surrounded by ice to keep the temperature below $45^\circ F.$, except in the case of the studies of the effect of temperature. The stiffness of the whipped cream was measured by the relative pressure required to force a metal disk into it. The effect of the homogenizing pressure, the age of the cream after separation, pasteurization, or homogenization, temperature of whipping, acidity, and the addition of viscogen, sugar, and flavoring extracts were also studied.

A summary of the results of whipping for 24-hour-old cream, differently treated, is given in the following table:

Effect of pasteurization and homogenization on the whipping quality of cream.

Percentage fat.	Age of cream	Time of whipping					Grade of stiffness of whipped cream.			
		Raw cream	Pasteurized cream	Raw homogenized cream	Pasteurized-homogenized cream		Raw cream	Pasteurized cream.	Raw homogenized cream.	Pasteurized-homogenized cream.
	Hours	Minutes	Minutes	Minutes	Minutes					
20	21	10	12	15	15		8	6	4	4
22	21	10	10				20	16		
25	21	8	8	12	12		24	22	8	6
27	24	6	6	12	12		32	30	12	8
30	21	5	5	12	12		48	45	20	12

The aging of cream was found to markedly increase the whipping qualities provided the cream was held below $50^\circ F.$ so that it did not become sour or rancid. Raw cream containing 20 per cent of fat improved until 120 hours old, 22 to 25 per cent cream improved until 96 hours old, whereas raw cream containing 27 per cent or more of butter fat reached its best whipping point at 48 hours of age. Similar results were obtained from the effect of aging of pasteurized, homogenized, and pasteurized-homogenized cream, which are given in order of their desirability for whipping.

The percentage of acidity had no effect on the qualities of the whip up to and including 0.3 per cent, above which the sour taste was evident. Temperature was found to have an important influence on the whipping quality especially with cream of a low fat content. No advantage was obtained with the temperature below $45^\circ F.$, or below $50^\circ F.$, with raw cream containing over 27 per cent of fat. The addition of sugar and flavoring extract to cream was of no advantage, whereas the addition of viscogen produced a better quality of whipped cream in some cases. It was found impossible to whip powdered cream containing as high as 40 per cent of fat, whereas evaporated milk would whip in from 5 to 7 minutes, but would not stand up when removed from the ice.

Manufacture of Cheddar cheese, T. HAMILTON (*Rhodesia Agr. Jour.*, 19 (1922), No. 2, pp. 177-186, figs. 9).—In this article general elementary directions are given for making Cheddar cheese.

The production of carbon dioxide and volatile acids by propionic bacteria with special reference to their action in cheese, J. M. SHERMAN and R. H. SHAW (*Abs. in Abs. Bact.*, 6 (1922), No. 1, p. 16).—In a paper presented before the Society of American Bacteriologists, the authors state that observations on the action of *Bacterium acidi-propionici* (*d*), a causal factor in the production of eyes and flavor in Swiss cheese, have shown that this organism is able to produce carbon dioxide, propionic acid, and acetic acid from succinates, glycerol, peptones, and perhaps butter fat.

The rind cancer of hard cheese, R. BURRI and W. STAUB (*Landw. Jahrb. Schweiz*, 35 (1921), No. 5, pp. 655-666, figs. 2).—The authors describe a fungus which attacks the surface of hard cheese, producing a wartlike appearance on the rind and penetrating the cheese to a distance of about 1 cm. (0.4 in.). The organism causing this condition is named *Oospora caseovorans*. The cultural characteristics of this fungus are given.

VETERINARY MEDICINE.

Report of the Advisory Committee on Research into Diseases in Animals, D. PRAIN ET AL. (*London: [Gt. Brit.] Development Comm.*, 1922, pp. 19).—This is a report of an advisory committee of nine appointed in November, 1920, which held 15 meetings and heard evidence from many authorities on the subject. The report is presented under the headings of the problem, existing facilities, extension of existing facilities, the training of investigators, and organization. A summary of the main conclusions and recommendations in the report is included.

On the biologic properties of pathogenic molds, S. S. GREENBAUM (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 26-31).—"A proteolytic ferment is common to all the pathogenic molds studied, but its solubility varies with the organism. They possess no amylolytic properties. They do not ferment saccharose, dextrin, glucose, levulose, maltose, or lactose, and they produce no acids or bases. The trichophytons (*Trichophyton acuminatum* and *T. gypsum-asteroides*) and *Achorion schoenleinii* elaborate toxins fatal to guinea pigs."

The pathogenicity of *Bacillus melitensis* and *B. abortus* for guinea pigs; studies on the genus *Brucella* n. g., IV, K. F. MEYER, E. B. SHAW, and E. C. FLEISCHNER (*Jour. Infect. Diseases*, 31 (1922), No. 2, pp. 159-197).—"The experiences collected in this paper indicate that certain strains of *B. melitensis* are capable of producing an acute, subacute, or chronic inoculation disease in guinea pigs. The gross anatomic and the histologic changes resemble those commonly noted in guinea pigs infected with *B. abortus*. In fact, it is sometimes impossible to distinguish the two infections without careful serologic cross absorption tests. Four cultures, 2 old strains isolated from human cases of undulant fever in 1896 and 1904, 1 human strain isolated in 1915, and 1 caprine strain recovered from goat's milk in 1917, infected guinea pigs regularly, while 18 other strains proved either nonpathogenic or produced in exceptional instances lesions in the spleen and lymph nodes. Aside from the inherent pathogenic property of certain strains, it is not unlikely that the individual susceptibility of the guinea pigs and the mode of injection are in a large degree responsible for the course and the character of the infection. Intratesticular injections have been used most frequently.

"Thirty-four of 44 guinea pigs, which were sacrificed from 44 to 155 days after the injection with cultures, presented advanced tuberculosis-like lesions

in the spleen and lymph nodes. The average weight of the diseased spleen was 1.7 gm. The largest spleen observed in these experiments weighed 3.5 gm. Localization of the disease in the liver and testicles, as well as proliferation of the bone structure, has been recorded. As a whole, the lesions produced by *B. melitensis* in guinea pigs are less extensive and severe than those produced by *B. abortus*.

"Experiments extending over several years support the well-known fact that *B. abortus* may produce in guinea pigs an interesting inoculation disease. However, the degree of tissue injury in the spleen and lymph nodes may vary considerably. Sexotropism, which follows any form of inoculation, whether caused by infected material or cultures, is remarkably constant. Infection involving all the tissues of the body, with the exception of the muscles, has been characteristic for a strain of *B. abortus* isolated from an aborted swine fetus. Enlargement of the spleen with a maximum weight of 10.5 gm. and an average weight of 4.69 gm. has been noted in guinea pigs injected with infected milk or tissues. Old laboratory cultures, as a rule, produce lesions which are so slight that they can not be seen with the unaided eye. This group of cases resembles anatomically the infections caused by intratesticular or intraperitoneal injections of certain *B. melitensis* cultures.

"Recently isolated strains and, in particular, cultures or milk specimens procured from goats affected with Malta fever should be tested for pathogenic properties on guinea pigs."

Previous studies on the genus *Brucella* have been noted (E. S. R., 46, p. 775).

The cultivation of *Bacterium abortus* Bang, C. P. Fitch (*Jour. Infect. Diseases*, 31 (1922), No. 3, pp. 233-236, fig. 1).—The medium which has given the most satisfactory results at the Minnesota Experiment Station in the cultivation of *B. abortus* is beef infusion agar adjusted to a pH of 6.8 to 7.2. Just before the medium is to be used it is melted, approximately 10 per cent of naturally sterile horse serum is added, and the tubes are placed in a slanting position for the medium to solidify. The tubes are then heavily seeded with the material to be tested and placed in a round museum jar, the capacity of which is known and which can be tightly closed. After the tubes are in place the cover of the jar is lifted sufficiently to admit a tube from a carbon dioxid tank, and approximately 10 per cent of the gas is added. The rubber tube is removed quickly, the cover of the jar screwed down tightly, and the jar placed at 37.5° C. for incubation. It is stated that after 24 hours' incubation small pin-point colonies can be noted, and after 48 hours well-developed colonies.

***Clostridium botulinum*, F. W. TANNER and G. M. DACK** (*Jour. Infect. Diseases*, 31 (1922), No. 2, pp. 92-100, figs. 5).—A study is reported of the resistance of spores of *Bacillus botulinus* (*C. botulinum*) to dry heat, and of the distribution of the organism in nature.

Rich spore cultures of different strains of the organism were exposed to dry heat at different temperatures and for varying periods of time. While the resistance to heat varied with the strains, the average survival period at 110° C. was over 120 minutes; at 140° there was a wide variation in survival period, from 50 to 60 minutes; and at the higher temperatures of 160° and 180° the survival period varied from 5 to 15 minutes. It is concluded that modern methods of dry sterilization are sufficient to sterilize apparatus used in the study of this organism.

In studying the distribution of *B. botulinus* in soils and in feces, inoculations of suspensions of the material examined were made in sheep-brain

medium, and after a sufficient period of cultivation under anaerobic conditions guinea pigs were fed 1 cc. each of the medium in all suspected cases. If toxin was found present the type of the culture was further investigated by the use of type A and B antitoxin. Eleven of the 73 samples of soil examined showed the presence of an organism producing the usual symptoms of botulism in guinea pigs. Seven of these cultures produced toxin sufficiently strong to cause the death of guinea pigs in from 12 to 15 hours, and all of these were found to be type B organisms. Three samples of feces from hogs gave positive and three from dairy cattle negative results. A specimen of raw sewage was found to contain an organism producing type B toxin.

Bacillus botulinus in swine diseases, R. GRAHAM (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 3, p. 316).—Supplementing a previous report on the presence of *B. botulinus* as a secondary invader in swine diseases (E. S. R., 46, p. 378), the author states that in two afflicted herds examined since the original report the presence of *B. botulinus* type A has been noted in the intestinal tract and internal organs of swine which suffered from cholera following the injection of serum and virus. It is further noted, however, that negative results have been obtained in testing approximately 100 samples of commercial hog-cholera serum and virus for *B. botulinus*, and "that it appears that botulinus intoxication in swine as a specific factor in 'breaks' may not be as significantly related to the contaminated serum and virus used in immunizing the herd as inferred in the earlier part of our studies."

The presence of diphtheria antitoxin in the blood of certain normal horses and its demonstration by the Schick test, H. W. SCHÖENING (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 3, pp. 286-294).—The sera of 17 normal horses were tested for the presence of diphtheria antitoxin by mixing 1 cc. of the serum with 2 M. L. D. of diphtheria toxin, allowing the mixture to stand for one hour at room temperature and then injecting it subcutaneously into guinea pigs. Five of the 17 guinea pigs thus treated survived, and repeated tests on the sera giving protection confirmed these results.

Similar tests conducted on a further series of 12 normal horses from the experiment station of the Bureau of Animal Industry, U. S. D. A., showed the presence of antitoxin in four cases. All of the animals in this series were then given the Schick test, which resulted negatively for the animals whose serum showed antitoxic properties and positively for those whose serum showed no antitoxic properties. Sufficient antitoxin was, however, produced by the Schick test in 3 of the 6 horses which had first reacted positively to give a negative reaction four weeks after the first test.

In discussing these results the author suggests the possibility that the diphtheria antitoxin thus demonstrated in the blood of a considerable percentage of the animals tested is the result of infection of wounds with the diphtheria organism from some attendant who was either suffering from diphtheria or an actual carrier. The Schick test is thought to be of practical value in determining the suitability of horses for the production of diphtheria antitoxin.

The plurality of foot-and-mouth disease virus, H. VALLÉE and H. CABRÉ (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 23, pp. 1498-1500).—Further evidence of the plurality of the virus of foot-and-mouth disease is afforded by the report that animals previously infected with the German virus (E. S. R., 47, p. 81) remained refractory to that virus but readily contracted the disease when exposed to the French virus. The authors are unwilling, as yet, to state whether the two forms of virus are two totally distinct microbial types or different races of the same virus.

A critique of the supposed rodent origin of human giardiasis. C. E. SIMON (*Amer. Jour. Hyg.*, 2 (1922), No. 4, pp. 406-434, pl. 1, figs. 9).—"On the basis of our morphological, biometrical, and experimental studies we believe to have established that specific differences exist between the human *Giardia* and the mouse form, as was first suggested by Bensen and subsequently by Kofoid and Christiansen [*E. S. R.*, 35, p. 52] and that similar differences also exist between the human form and the meadow mouse form and between the latter and the mouse form, as was first suggested by Kofoid and Christiansen, though in both instances on what we regard as insufficient evidence.

"It seems warrantable to assign species names to the three forms, and we accept that of *G. muris* for the mouse form, as suggested by Bensen, and the name *G. microti* for the meadow-mouse form, as suggested by Kofoid and Christiansen. For the human form we believe that Stiles . . . is justified in rejecting Kofoid's term *G. enterica*, and that according to the rules of nomenclature the organism should henceforth be known as *G. lamblia*.

"Culture rats and wild rats can not be infected with *G. lamblia*, while they may be readily infected with *G. muris*. Culture rats, wild rats, and wild mice can not be infected with *G. microti*. There is no basis for the assumption that the human infection is referable to either rats, mice, or meadow mice. We believe that the human infection is of human origin."

Why does an animal affected with glanders give a reaction when injected with mallein, while a healthy animal does not? R. A. ARCHIBALD (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 3, pp. 295-300).—A theoretical discussion

Investigations on the use of vaccines made from *Bacillus ovissepticus*, I. E. NEWSOM and F. CROSS (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 5, pp. 562-579). Data are presented from the Colorado Experiment Station on the use of vaccines consisting of strains of *B. ovissepticus*, administered living or destroyed by heat or by the action of phenol. Little protection was secured in either rabbits or sheep by the heat-destroyed organisms and only slightly greater protection by the organisms destroyed by phenol. Some protection was afforded by the use of live organisms administered in considerable amounts.

Suggestion of *Spirochaeta neotropicalis* as a name for spirochete of relapsing fever found in Panama, L. B. BATES and J. H. ST. JOHN (*Jour. Amer. Med. Assoc.*, 79 (1922), No. 7, pp. 575, 576).—"The causative agent of relapsing fever in Panama, recently shown to be transmitted by *Ornithodoros talaje* Guer.-Men. (*E. S. R.*, 46, p. 682), has been found, by the authors to represent a distinct species, variety, or strain, for which they propose the name *S. neotropicalis*.

Experimental production of bovine mastitis with streptococci and other bacteria, C. M. CARPENTER (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 1-9).—"Milk containing hemolytic and nonhemolytic streptococci from infected udders produced a more severe mastitis than 24-hour broth cultures of the same organisms when equal amounts were injected into the teat canals of healthy cows. *Streptococcus viridans* isolated from diseased genital organs of cattle, *Bacterium abortum*, and *B. pyocyaneum* produced only a slight inflammation of the udder when injected into the teat canals. The mastitis cleared up in from 48 to 72 hours after injection. *B. coli* produced an acute mastitis which cleared up eight days after injection. *Staphylococcus aureus* and *Pasteurella bovisseptica* produced a severe mastitis which destroyed the functional activity of the gland. The age of the animal and the amount of milk given by the animal at the time of the injection of the various organisms are two factors which influence the degree of mastitis produced."

The streptococci of the bovine udder.—IV, Studies of the streptococci, S. H. AYERS and C. S. MUDGE (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 40–50).—"The typical streptococcus of the udder of the cow was found to be *Streptococcus mastitidis*. Cultural characteristics of two varieties of this organism are described. *S. mastitidis* is practically identical with *S. pyogenes* when the usual cultural characteristics are studied. They are separated largely on the difference in final pH and difference in ability to hydrolyze sodium hippurate.

"Cultural characteristics are presented of a few other streptococci which are not included with *S. mastitidis*. An apparently new species is described which, because of the small amount of acid produced in test substances, is termed *S. acidominimus*. It is shown that streptococci are frequently found in the udders of normal cows, and that the same species are also present in cases of mastitis. There appears to be no reason to believe that *S. mastitidis* is pathogenic for man when consumed in milk, and it can apparently be readily distinguished from *S. pyogenes*."

Previous articles in this series have been noted (E. S. R., 45, p. 484).

The local inflammatory reaction produced by the tetanus bacillus, F. H. STANGL (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 22–25, figs. 4).—"When typical tetanus is produced in guinea pigs by injection into the thigh muscles and foot pads of suspensions of tetanus bacilli, an intense inflammatory reaction promptly ensues at the site of inoculation, in which both wandering and fixed cells take part. The tetanus bacillus exerts a positive chemotaxis and is taken up by polymorphonuclear leucocytes; it also induces the formation of giant cells. In one human case the local reaction to the tetanus bacillus corresponded in all essentials to the reaction of experimental inoculation in guinea pigs."

Avian tuberculosis, A. F. SCHALK (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 4, pp. 397–410).—This contribution from the North Dakota Experiment Station consists of a general discussion of avian tuberculosis, including its distribution and economic importance, causes, susceptibility of various fowls, differential diagnosis, transmission within the flock and from flock to flock, symptoms, autopsy findings, the intradermal test, and prevention and eradication measures.

[Tuberculosis investigations of the California Station] (*California Sta. Rpt.* 1921, pp. 128–130).—In continuation of previous work (E. S. R., 38, p. 380), as to making cattle environs free from infective tuberculous material, J. Traum has found that manure from tuberculous cattle when exposed in 1 to $\frac{1}{2}$ in. layers on the ground failed to produce tuberculosis in guinea pigs and cattle after being thoroughly dried, but when kept moistened produced tuberculosis in guinea pigs after 687 days of exposure in one series, and 548 days in another. Tuberculous material, when mixed with manure and kept moist for 255 days, produced tuberculosis in three out of five cattle when placed in the drinking water. In an earlier experiment, conducted on the same lines, 18 out of 21 cattle developed tuberculosis.

A report on the time of appearance of the local reaction in the intradermal tuberculin test has been essentially noted from another source (E. S. R., 46, p. 377).

The complement fixation reaction in the diagnosis of bovine tuberculosis, L. PANISSET, J. VERGE, and E. GRASSET (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 3, pp. 189, 190).—The results are reported of the complement fixation test for tuberculosis as applied to the sera of 148 tuberculous and 63 healthy cattle. Positive results were obtained in 90.5 per cent of the tuberculous and 11.1 per cent of the nontuberculous animals. In making the test it is

considered necessary to inactivate the suspected serum by heating for half an hour at 60° C. in order to diminish the spontaneous anticomplementary properties of the serum. Keeping the serum in the ice box for from 2 to 21 days was found not to alter its richness in specific antibodies or to increase its anticomplementary properties.

A negative fixation reaction in certain tuberculous cattle which react to tuberculin is considered to be due to the absence of antibodies in the sera of these animals. The sera of tuberculous cattle not treated with tuberculin are poor in antibodies. Tuberculin injected into animals already infected is thought to increase the richness of their sera in specific antibodies, while it has no effect on healthy subjects.

The fixation reaction and the tuberculin reaction are considered not to have the same significance in tuberculous cattle, although a certain parallelism exists between the frequency of positive results in the fixation reaction and the extent of tuberculous processes. The sera of animals affected with chronic hypertrophic enteritis also deviates the complement in the presence of the tuberculous antigen, thus showing that the reaction is only of a relative and limited specificity for tuberculosis.

Lymphangitis in cattle caused by acid-alcohol-fast organism (*California Sta. Rpt. 1921, pp. 130-131*).—In continuation of previous studies on lymphangitis in cattle (E. S. R., 41, p. 782), J. Traum has investigated material from three additional cases.

The first animal, a definite reactor to the intradermal tuberculin test, showed a conglomerate mass of nodules which yielded a fairly large number of acid-alcohol-fast organisms varying in size and shape. Three guinea pigs and one rabbit inoculated with the material remained normal, and nothing of diagnostic value could be obtained following the inoculation of various culture media. Subsequent to the removal of the nodules the cow reacted negatively to the subcutaneous and intradermal tuberculin tests.

From the nodules of the second, reacting negatively to the intradermal tuberculin test, a number of short kidney-shaped acid-alcohol-fast organisms were isolated. Cultures and animal inoculations from this case were negative, with the exception that a young rabbit showed at the end of 10 days following inoculation a nodular mass containing large numbers of acid-alcohol-fast organisms.

The third, which gave a slight reaction to the intradermal test, had a large number of cutaneous and subcutaneous nodules on both front limbs and on the right chest wall. From these a few indistinct acid-fast organisms were isolated, but animal inoculation with these has resulted negatively.

A fourth case is cited which resembles clinically the lymphangitis caused by acid-fast organisms, with the exception that several of the nodules extended deeper into the muscles and the superficial nodules showed a greater tendency to ulceration. Cultures made from several nodules yielded a large number of colonies of the Preisz-Nocard bacillus.

The blood of healthy sheep: Transmission experiments with infectious anemia of sheep, F. SCHANTZ (*Monatsh. Prakt. Tierheilk.*, 31 (1920), No. 3-4, pp. 130-159, pl. 1).—Transmission experiments show that sheep are not susceptible to infectious anemia, thus confirming the findings of the Japanese Commission (E. S. R., 32, p. 881). A list is given of 18 references to the literature.

The bacteria in normal and diseased lungs of swine, R. S. SPRAY (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 10-21).—This paper reports the bacteriologic study of 100 apparently normal lungs of pigs and 314 lungs which showed pneumonic lesions of varying extent and intensity.

"Three organisms of possible significance were isolated from the normal lungs. *Bacillus suisepcticus* was found in 4 per cent of the 100 specimens; in 2 per cent it was present in pure culture and in large enough numbers to suggest the possibility of an impending pneumonia; in the other 2 per cent there were only a few colonies of this organism, together with a mixture of other bacteria. A nonfermenting, typhoid-like bacillus, considered a *B. alkaligenes* type, was found in pure culture in 1 case and in mixed culture in 2 other cases. An inulin-fermenting streptococcus was isolated from 12 per cent of the cases; in 5 cases there were many colonies present, while in the other 7 cases there were a few colonies together with other organisms; no pure cultures were observed. A variety of other organisms, particularly streptococci, were observed in small numbers, and always in mixed culture.

B. suisepcticus was found in pure culture in 138 cases, or 44 per cent of pneumonic lungs examined, and in small numbers mixed with other organisms in 30 more cases. The inulin-fermenting streptococcus was found in pure culture in 91 cases, and in an additional 6 per cent of specimens it was present in mixed culture in small numbers, making a total of 111 specimens. No other organisms appeared in pure culture, nor in mixed culture in sufficient numbers to indicate any etiologic significance.

"The 2 strains *B. suisepcticus* and the inulin-fermenting streptococcus were found in pure culture or together in approximately equal numbers in 63 per cent of the 314 specimens examined. A study of the imbedded tissues is being made and will be reported later. It appears to be generally accepted that the mere presence of *B. suisepcticus* constitutes sufficient evidence as to its etiologic significance in swine pneumonias. Judged by the same criterion, the streptococcus here described would seem to be of almost equal importance.

"Agglutination tests with a single serum indicate that there are at least 2 types within the group of 128 strains of the streptococcus studied. Further work is in progress and will be reported later."

Intestinal worms in swine, W. L. ROBINSON (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 5-6, pp. 98-102, fig. 1).—This is a brief summary of information, including the mode of infestation of *Ascaris*, life history, harmful effects, preventive measures, and medicinal treatment.

Infectious abortion of swine (*California Sta. Rpt. 1921*, pp. 131-132).—Essentially noted from another source (E. S. R., 46, p. 884).

The serum treatment of hog cholera, R. GRAHAM (*Illinois Sta. Circ.* 261 (1922), pp. 11, figs. 3).—This is a revision of Circular 207 (E. S. R., 38, p. 589).

The precipitation of colloidal gold in the cerebrospinal fluid of horses with dourine, F. H. K. REYNOLDS and H. W. SCHÖENING (*Jour. Infect. Diseases*, 31 (1922), No. 1, pp. 59-63).—The colloidal gold test applied to the spinal fluid of horses suffering from dourine gave reactions of varying intensity in many instances, but the exact significance of these reactions has not yet been determined. Several specimens of the spinal fluid gave positive results of the complement-fixation test for dourine.

Poultry diseases (*California Sta. Rpt. 1921*, pp. 140, 141).—Investigations by J. R. Beach of the cause of the sudden death of a number of apparently healthy hens in the University Farm flock revealed the presence of ruptured ova in the abdominal cavity of nearly all such hens. The fowl-cholera organism was isolated from 62 per cent of these dead birds.

Further studies were conducted of the nutritional disease of poultry described by Beach in a previous report (E. S. R., 44, p. 782). The deaths appear to have resulted from the feeding of a ration deficient in green food.

In an investigation by C. D. Carpenter of the comparative value of hydrochloric acid (0.5 oz. per gallon of water) and buttermilk to control coccidiosis of chicks, the disease was checked by both methods in about the same time. However, the chicks given buttermilk averaged 1 lb. per dozen heavier at the end of the experiment than those given hydrochloric acid.

Chicken pox (*epithelloma contagiosum*) (*California Sta. Rpt. 1921, pp. 139, 140*).—Continuing the investigation previously noted (E. S. R., 44, p. 782), J. R. Beach has conducted further studies on methods of preparation and administration of chicken-pox vaccine. Absolute protection against artificial infection was not secured by the subcutaneous injection in 1 cc. doses of a 5 per cent suspension of powdered desiccated virus in sterile glycerin, diluted in salt solution to give a concentration of 1 per cent virus. Pricking the comb first with a needle dipped in this glycerin suspension gave neither lesions nor immunity, and similar negative results were obtained by pricking the comb with a needle dipped in a concentrated filtrate (Berkefeld) of a shake extract of desiccated virus. Vigorous scarification of the comb with this filtrate caused marked lesions, as did also pricking the comb with a needle dipped in a suspension of 1 gm. of freshly collected virus in 4 cc. of sterile glycerin. Fowls thus infected were not immune to further infection 10 days later.

A compilation of reports giving the results of vaccination in 208 flocks consisting of 117,348 fowls, of which 99,352 were healthy at the time of vaccination, showed a percentage of 8.29 of healthy fowls that become infected after vaccination.

Chicken lice and mites (*Ohio Sta. Mo. Bul., 7 (1922), No. 5-6, p. 97*)—The dipping of birds on a warm day in warm water to which 1 oz. of sodium fluorid has been added for each gallon of water is said to have been the most satisfactory method of eradicating lice from flocks at the station, being inexpensive and easy of application.

RURAL ENGINEERING.

California irrigation district laws (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 1 (1922), pp. 163*).—The text of the California irrigation district law, as amended in 1921, is presented in this bulletin.

Irrigation in British Columbia, E. A. CLEVELAND (*Engin. Jour. [Canada], 5 (1922), No. 8, pp. 417-422*). A brief review is given of irrigation in the Province of British Columbia from the earliest undertaking up to the present extensive systems.

Report of the Water Conservation and Irrigation Commission for the year ended June 30, 1921 (*N. S. Wales Water Conserv. and Irrig. Comm. Rpt., 1921, pp. 32, pl. 1*).—This report deals with irrigation areas established and controlled by the State, irrigation schemes under consideration, water conservation works constructed by the State but administered by local trusts, national works maintained by the commission, artesian and shallow boring, and licensed works for stock and domestic water supply, irrigation, and other purposes.

The California pipe method of water measurement, B. R. VANLEER (*Engin. News-Rec., 89 (1922), No. 5, pp. 190-192, figs. 3*).—A method of measuring water where the discharge of the water is not submerged or under pressure is described for the use of irrigation farmers and dredge pump operators, and tabular data are given to assist in its use. The method of measurement is based upon the principle that if water is delivered to a short pipe nipple with a zero or a very small velocity head, then for the same size of pipe and the same quantity the depth of water in the pipe will always be the same.

Return-flow water from irrigation developments, R. I. MEEKER (*Engin. News-Rec.*, 89 (1922), No. 3, pp. 105-108).—Studies are reported which show that ordinarily 50 per cent of the water diverted for irrigation purposes becomes a source of return flow.

Annual return flows of from 35 to 65 per cent of the river flow diverted were measured for large compact irrigated areas. In the South Platte and tributary valleys in Colorado, where 1,100,000 acres are irrigated, return flow was found to amount to 1,000,000 acre-ft. annually. In the Cache la Poudre Valley, where irrigation is intensive and 250,000 acres are irrigated, the annual return flow is 130,000 acre-ft., or about 0.5 acre-ft. per acre. In the North Platte Valley of Nebraska, where water is plentiful, the annual returns from 250,000 acres are 1.6 acre-ft. per acre. Annual drainage returns on two Colorado projects of 5,000 and 30,000 acres fell close to 1 acre-ft. per acre.

It was found that monthly returns throughout the year are not constant. The return is maximum during the summer and fall months and minimum during the winter and spring.

It is concluded that from 50 to 60 per cent of the return flow under natural or artificial drainage occurs during the irrigation season and is available for re-use.

Soil erosion, G. ROBERTS, J. B. KELLEY, and E. G. WELCH (*Ky. Agr. Col. Ext. Circ.* 129 (1922), pp. 34, figs. 16).—Information on the prevention of erosion of Kentucky soils by means of terracing and soil-saving dams is presented.

Instructions to bidders, specifications, proposal, contract, and contract bond (*Raleigh: N. C. State Highway Comm.*, pp. 31, 3B, 3C+188, figs. 2).—This is a standard form used by the North Carolina State Highway Commission in requesting bids for the construction of highways.

Characteristics of concrete brick masonry, H. A. DAVIS (*Concrete [Detroit]*, 21 (1922), No. 1, pp. 10-13, figs. 10).—Studies conducted at Columbia University on 45 concrete brick piers composed of wet mixed concrete brick of 13 different mixtures in comparison with 12 piers built in the same manner of 3 brands of Hudson River clay common brick are reported.

It is concluded that specifications for concrete brick for building purposes should recognize the fact that the ratio of the compressive strength of the masonry to the compressive strength of the individual brick is considerably higher and varies with the compressive strength of the brick in the case of wet mixed concrete brick, while this ratio is fairly constant for clay brick. This is taken to indicate that to produce masonry of the same strength, the strength requirements of individual brick would be considerably lower in the case of wet mixed concrete brick than for clay brick.

Quantities of materials for concrete, D. A. ABRAMS and S. WALKER (*Lewis Inst. Struct. Materials Research Lab. Bul.* 9 (1921), pp. 21).—Tables of proportions and quantities of materials for concretes of compressive strengths varying from 1,500 to 4,000 lbs. per square inch are presented in this bulletin. The data constitute a résumé of the results of a large number of laboratory investigations.

Making concrete, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 127-129).—Brief practical information on the proportioning and mixing of concrete is presented.

Tile size standardization, J. A. KING and R. L. PATTY (*Agr. Engin.*, 3 (1922), No. 7, pp. 119-121).—The relative costs and capacities of commercially available drain tile are tabulated and discussed, including sizes from 4 to 72 in. It is stated that the bulk of the drain tile now made by clay and cement companies follows the size variations shown quite uniformly. It is noted that the

sizes increase in units of 2 in. up to 48 in., and beyond this point increase in units of 6 in.

The tentative conclusion is drawn that the wisdom of increasing diameters by less than 2-in. units is questionable, and that when the 24-in. and larger sizes are reached it is indefensible. It is thought that the 4, 9, and 15 in. sizes could be dispensed with altogether. Somewhere near the 30-in. size it is considered logical to change to a unit increase of 3 in. instead of 4 in., and at about the 40-in. size to a unit increase of 4 in.

A mathematical discussion of the subject by D. Weeks is included.

Disintegration of cement tile in peat, F. J. ALWAY (*Jour. Amer. Peat Soc.*, 15 (1922), No. 3, pp. 15-25).—In a contribution from the Minnesota Experiment Station, a review is given of information relating to the disintegration of concrete in peat soils, more particularly under European conditions.

The conclusion is drawn that some peats are able to disintegrate cement tile as the latter are now commonly made, and in the case of high-lime peats, if any acid has caused injury to the tile, this may be attributed to the oxidation of associated iron sulphid rather than to the action of organic acids. It appears that cement and concrete may be safely used in some peats while in others they are to be avoided, the determining factors being the chemical character of the peat itself and the presence of iron sulphid in the peat or underlying muck and of soluble salts of sodium and magnesium in the drainage water. Thus it would appear that cement tile may be used without risk in high-lime peats that are free of iron sulphid, but are subject to attack and possibly to disintegration in low-lime peats.

Durability of concrete tile in peat, J. T. STEWART (*Jour. Amer. Peat Soc.*, 15 (1922), No. 3, pp. 26-32).—The results of experiments on lines of concrete tile laid in peat soils are briefly reported.

The conclusion is drawn that there can be no action on concrete tile by so-called humic acids except in the low-lime peats, so that there is no dangerous menace from this source in the most intensely acid peats. Iron sulphid is found to decompose concrete in the presence of air, but since it occurs chiefly at the point of contact of peat with mineral soil there is considered to be little or no danger from this source in deep peat or in trenches backfilled with material containing lime or carbonates. Hydrogen sulphid will decompose concrete, but can be generated only in deep, poorly drained peat.

Paint protection for wood, C. T. MYERS (*Mech. Engin.* [New York], 44 (1922), No. 8, pp. 519, 520, 545, figs. 2).—Attention is drawn to the dearth of information as to the relative values of various kinds of paints and primers for the protection of wood against moisture, and a preliminary analysis of the subject and a summary of available information is given indicating the need for research on the subject. The importance of information on the durability and dimensional stabilization of painted articles is especially emphasized.

Tests made on small pieces of hickory, oak, birch, and maple measuring 1 by 1 by 1 in. to obtain comparative data on the paints and primers on the market showed that paints of the ordinary brands and formulas were not effective as moisture-proofing agents even when three coats were applied. A preliminary test with a casein solution indicated that it has waterproofing qualities which for some classes of protection may be very valuable. The same was true of some of the pyroxalin compounds. Varnishes were in general found to be more effective than paints, but in the protection of wheels its application was not suitable for primary coats.

Wearing test of manganese steel, soft center steel, and chilled cast-iron plowshares (*California Sta. Rpt.* 1921, p. 99).—Experiments by A. H. Hoffman

are reported in which one share of each material was used on the same 3-bottom tractor gang plow position, being interchanged after approximately one-third of each test had been run. The least wear was shown by the chilled cast-iron shares, slightly more by the soft center steel, and considerably more by the manganese steel.

Considerations affecting belt speeds, A. B. WELTY (*Agr. Engin.*, 3 (1922), No. 7, pp. 115, 116).—A brief mathematical analysis of the subject is presented, with particular reference to the operation of farm machinery.

The tractor as a means of farm power, D. T. MUSSELMAN and E. C. SAUVE (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 129-132).—A discussion of the various factors which relate to the use of the tractor on the farm is given, together with a table of tractor performance records on various operations, including plowing, disking, harrowing, grain binding, threshing, feed grinding, and wood sawing.

The Ahart method of tractor plowing, J. L. AHART (*Agr. Engin.*, 3 (1922), No. 7, pp. 116-118, figs. 2).—This method is briefly described.

The house-owner's book, A. L. CHURCHILL and L. WICKENDEN (*New York and London: Funk & Wagnalls Co.*, 1922, pp. XVI+388, pls. 4, figs. 63).—This is a manual intended for the guidance of those who are interested in the building or conduct of homes. It contains chapters on becoming a house owner, materials, carpentry, heating and ventilating, paints and painting, treatment of floors and woodwork, lighting the house, electricity, the water supply, drainage, plumbing, special appliances, the garage, recipes, and safety in the household.

Farm building plans available, G. A. FAIN and W. E. BROACH (*Ga. Agr. Col. Bul.*, July, 1922, pp. 4).—The farm building plans available at the Georgia State College of Agriculture are listed. These include general purpose, beef, hog, dairy, hay, and tobacco barns, sweet potato curing houses, dipping vats, cold storage plants, smokehouses, sewage disposal systems, poultry houses, farm-houses, implement sheds, and miscellaneous structures.

Farm buildings for small holdings: Variations from the normal, H. P. G. MAULE (*Jour. Min. Agr. [London]*, 29 (1922), No. 3, pp. 230-233, pls. 3).—Brief popular information on the planning and construction of farm buildings for small English farms is presented, including plan drawings.

Poultry houses for Kansas, N. L. HARRIS (*Kans. Agr. Col. Ext. Bul.* 34 (1922), pp. 11, figs. 10).—Brief popular information on the types of poultry houses especially adapted to the needs of the State of Kansas is presented in this bulletin. These include the shed roof, the semimonitor, and the gable roof or straw loft types.

The Michigan poultry house, E. C. FOREMAN (*Michigan Sta. Quart. Bul.*, 4 (1922), No. 4, pp. 124-127, figs. 2).—Brief practical information on the requirements of a poultry house for Michigan conditions is presented.

The New Jersey suburban unit house, W. P. THORP, JR. (*New Jersey Stat. Hints to Poultrymen*, 10 (1922), No. 10, pp. 4, figs. 2).—Drawings, brief specifications, and a bill of materials for this poultry house are given.

Utilization of flue-heated tobacco barns for sweet potato storage, F. E. MILLER (*U. S. Dept. Agr., Farmers' Bul.* 1267 (1922), pp. 4-8, figs. 5).—These pages contain practical instructions for remodeling flue-heated tobacco barns so that they may also be used for the storage of sweet potatoes.

The farm water supply.—I, Simple water systems and plumbing, F. G. BEHREND (N. Y. Agr. Col. (Cornell) Ext. Bul. 50 (1922), pp. 117-191, figs. 66).—Practical information on the planning and installation of systems to supply running water in farm homes is presented in this bulletin. A large

number of illustrations are included, showing the different operations in the process of installation and the details of the different parts and tools used.

Turn on the water, N. S. FISH (*Wis. Agr. Col. Ext. Circ. 147* (1922), pp. 11, figs. 7).—Brief popular information on small farm water supply systems is presented in this circular.

Disposal of creamery refuse, A. P. WILSON (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 21 (1922), No. 4, pp. 399-411, pl. 1, fig. 1).—Studies on the purification of creamery sewage by means of septic action and activated sludge treatment are described. The experiments were conducted on a small scale with sewage and septic tank effluents under varying conditions in 40-gal. barrels. Six barrels, each having a diffuser, were fitted and aerated. The septic tank effluent and the raw sewage were experimented with alone and combined with lime and with ground limestone. The septic tank effluent used was foul smelling and acid when added to the experimental tanks.

It was found that under the activated sludge treatment the odor and acidity disappeared almost at once. While the percentage of purification was lower than in the case of raw sewage, the final effluent attained a much higher standard of purity. The effect of the addition of whey to the sewage was evident during the first period, and it influenced the composition of the septic effluent during the second period to a slight extent. The results indicate that the septic tank acts as a balancing tank equalizing the strength of the effluent. A great deal of the curd is retained in the septic tank as scum and sludge. When the sewage was submitted to preliminary septic action before treatment by the activated sludge process the oxygen absorption figure of the effluent was reduced to less than half that obtained when treating the fresh sewage. The preliminary septic action more than doubled the purification effected.

It is concluded that in many cases treatment of creamery sewage by the activated sludge process would be sufficient, and that the plant could be operated in the open and close to the creamery without nuisance. Where further purification is necessary the effluent, after aeration of the sewage, can be treated in bacterial beds of either the contact or percolating type. Where a very high degree of purification is required, it is considered better to submit the sewage to slight septic action about two days before treating the liquor by the activated sludge process.

It is further concluded that no general rule as to the plan to be adopted can be laid down, but that the method selected in each case must be decided upon after a careful examination of the local conditions.

The fieldmen's manual (*Chicago: Mutual Fire Prevention Bur.*, 1921, pp. [3]+260+[9], pl. 1, figs. 78).—This is a handbook of fire prevention adapted to flour mills and grain elevators. It contains chapters on the fieldman, flour mills, elevators, data for figuring valuations, external hazards, electrical inspections, power except electric, machinery and special hazards, the bucket elevator, heating, interior fire protection, exterior fire protection, lightning protection, superior building construction, watchman service, fumigation, and miscellaneous.

RURAL ECONOMICS AND SOCIOLOGY.

An introduction to the theory of business administration for farming, E. LAUR (*Einführung in die Wirtschaftslehre des Landbaus*. Berlin: Paul Parey, 1920, pp. XII+287).—This book is presented as a reader in the economics of agricultural production. A sketch of world agrarian history is included, setting forth particularly the development of agriculture in ancient times and that of present-day landholder and laborer relationships. The

natural sciences as the basis of agriculture, main points of labor questions and theories of intensity, diminishing returns, and the economic use of feeds and fertilizers are discussed. Various examples of types of agriculture, including that of migratory peoples; the grazing industry in North America, Australia, and Alpine regions; grain farming; and intensive forms of the production of raw materials for industry and food production are described. Comprehensive treatment is given of the theories and methods of double-entry bookkeeping for agriculture, as well as formulas for estimating the returns on different business methods.

Farm management and farm organization in Sumter County, Ga.—An analysis of the business of 534 farms in 1913 and 550 farms in 1918, H. W. HAWTHORNE, H. M. DIXON, and F. MONTGOMERY (*U. S. Dept. Agr. Bul. 1034* (1922), pp. 97, pls. 4, figs. 8).—This bulletin presents data regarding the organization, production, expenses, and returns of farms operated by owners and tenants, both white and colored, being a repetition of the farm business analysis of farms in the same region in 1913 (*E. S. R.*, 36, p. 893). The method used in this study is the same as that previously noted (*E. S. R.*, 44, p. 89).

The data for 1918 in comparison with those for 1913 show a decrease in cotton acreage of from 57 to 37 per cent of the total crop acreage and an increase in corn acreage of from 28 to 37 per cent, as well as increases in acreage of wheat, peanuts, and other legumes. Applications of fertilizer decreased 37 per cent. The production of hogs for marketing was substantially increased.

This analysis was carried on separately for farms operated by white owners and tenants and by colored owners and tenants, and the data presented offer comparisons between these classes of farmers. White owners operated about half of both the 534 farms studied in 1913 and the 550 studied in 1918, these farms representing more than two-thirds of the total crop acreage reported and producing almost three-fourths of the cotton. Colored tenants were the most numerous of the other classes, operating one-third of all farms, handling one-sixth of the crop acreage, and producing almost one-sixth of the cotton.

The following table is a summary of some of the indicated changes:

Summary of farm business on farms in Sumter County, Ga., 1913 and 1918.

Kind of occupant.	Number of farms.		Crop acreage.		Average farm income.		Average labor income.		Average return on capital.		Estimated value of family living from farm in 1918. ¹
	1913	1918	1913	1918	1913	1918	1913	1918	1913	1918	
			Per ct.	Per ct.					Per ct.	Per ct.	
White owners....	268	280	72	69	\$1,665	\$3,711	\$474	\$1,813	7	11.3	\$716
White tenants....	49	56	6	8	584	1,353	505	1,232	8.4	9.4	580
Colored owners....	31	48	5	7	805	1,778	283	1,058	7	13.7	587
Colored tenants....	186	106	17	16	323	843	290	768	8.0	14.1	434

¹ No data for 1913.

² Landlords of tenants.

The appendix presents a summary of the farm business of each of the farms covered in this study in 1913 and in 1918.

Farm management [Investigations at the California Station] (*California Sta. Rpt. 1921, pp. 100, 101*).—Notes on investigations, carried on under the direction of R. L. Adams, are submitted here, pertaining to the costs of establishing 16 fruits and 3 field crops under conditions in California as in 1915 and

1919, as well as of the annual per acre charge to cover their pro rata of the cost of bringing them to a self-supporting productive stage.

Other investigations with reference to leasing methods and the number of sugar beet factories operating in the State are briefly reported on.

Investigations relating to the profits of Swiss agriculture for the crop year 1920-21. E. LAUR ET AL. (*Landw. Jahrb. Schweiz*, 36 (1922), No. 1, pp. 1-81).—This adds data for the later year to the reports previously noted (*E. S. R.*, 47, p. 491).

In regard to the bases of the economic rearrangement of fields in Bavaria. LABER (*Landw. Bayern*, 11 (1921), No. 1, pp. 29-32).—This discussion concerns mainly the conditions under which rearrangement would be advisable. The author concludes that for any given district the necessity for reform depends upon the percentage that the farms made up of scattered fields is of those consisting of a single tract and also upon the relative average distances apart of the constituent parcels.

Farm ownership and tenancy in the Black Prairie of Texas. J. T. SANDERS (*U. S. Dept. Agr. Bul.* 1068 (1922), pp. 60, figs. 7).—This study is based mainly on data collected in six representative counties in eastern central Texas from 368 farm operators. Historical information was gathered from tax rolls and other local sources.

The growth of tenancy in this region has been comparatively very rapid, the greatest increase having taken place when the stock raising industry was superseded by crop growing and the large farms were divided up. The net return to the owners of rented land was 5.9 per cent on capital invested. Increases in land values equaled a net compound annual interest of from 8 to 9 per cent on the original investment. On the basis of the average net accumulation of wealth in 1919 and the average value of farms operated, it has been determined that it would require the average share tenant interviewed approximately 28 years to pay for the farm he operated. The ability of operators to accumulate wealth was found to vary widely. Fourteen operators, or 3.8 per cent of all interviewed, together saved annually as much as 238 other operators who ranged among the least thrifty. Those who accumulated wealth most rapidly were the ones who had been most consistent in the application of their time to operating farms, had the most diversification of farm enterprises, raised the largest amounts of family food on the farm, and moved least frequently from farm to farm.

Legal phases of the land problem are described and economic aspects of the forms of tenure, operators being classified as share croppers, share tenants, owners additional, or owners operators, are set forth in detail. The agricultural history of farm operators is given to account for success or lack of it on the part of the operators interviewed. A study of domestic, social, and educational conditions in relation to tenure reveals the prevailing average disparity between the construction and repair of homes of owner operators and tenants. Standard of living, use of conveniences, school records of the children, and character of reading material found in the homes of the different tenure classes are contrasted.

Regulations for the protection of lease contracts. SCHUMACHER (*Deut. Landw. Presse*, 48 (1921), Nos. 20, p. 153; 21, p. 162).—These are discussed by the author as belonging to a series of special regulations based on laws passed during or after the war and designed to assist German industries through the post-war depression and readjustment. The regulation described here relates to agricultural lease contracts in Prussia, but it is noted that similar ones are in existence in all States of the Republic. The regulation is administered

by a series of arbitration committees, one for each judicial district of the district court, consisting of a district judge, who is president, two landholders, and two tenants. Their functions and powers are described in considerable detail. References are made to particular cases in illustration.

The present situation with regard to agricultural credit in the United States (*Fed. Reserve Bul.*, 8 (1922), No. 3, pp. 261-266; also in *Econ. World*, n. ser., 23 (1922), No. 11, pp. 364-267).—A digest is given of legislation proposed by the Joint Commission of Agricultural Inquiry, the Federal Advisory Council, and the President's Agricultural Conference, containing the suggestions therein as to means of providing more abundant credit for periods of time suited to farmers' needs.

The influence of existing circumstances on the market for agricultural mortgages, GARCKE (*Deut. Landw. Presse*, 48 (1921), No. 44, p. 333).—The author calls attention to the complaint by many agricultural societies that farm mortgages are being paid off at once rather than by the long-time amortization plan, and raises the question of which is advantageous from the farmer's point of view. He concludes that on account of risks in the farmer's business, the necessity for making improvements in the future, the establishment of married children in business, etc., the farmer should be advised to pay off all existing mortgages, especially those on the land. He then discusses the attitude that credit societies should maintain in making loans on the present inflated land values, and points out the difference between the loan value of a tract of land and its sale value.

Some problems in the science of taxation, P. HOLDEFLEISS (*Deut. Landw. Presse*, 48 (1921), No. 80, p. 595).—Problems of the capital valuation of agricultural land as a preliminary to purchase, sale, or lease are discussed. The author calls attention to the prevailing tendency in Germany to overvaluation by landlords and land sellers, as well as by officials, using gross income in terms of money. He proceeds to point out the error of this by describing the many elements in cost of production, labor costs, and post-war burdens of taxation, as well as supervision costs, insurance, and risks by which the gross income is reduced even without taking into consideration the existing deflation in money values.

The taxation of land, R. T. ELY (*Natl. Tax Assoc. Proc.*, 14 (1921), pp. 228-300, figs. 6).—This is a discussion of the demand made by liberty and democracy out of necessity and on the basis of social justice for increased and widely diffused taxation and of the possibilities of land as a basis of increasing revenues.

Land is said to be a poor man's investment, yielding small returns. Taxation brings into use submarginal land and brings land into use prematurely, and it is urged that tax policies should be framed with the end in view of preventing this. Holders of land out of use are held to perform active social and economic services by making possible a so-called ripening process by maintaining a reserve of land for food production in times of need and by taking the risks of ownership, paying taxes and special assessments.

Land values depend upon the growth of the population, but also upon the rate of improvement in land utilization. Land values have lost in comparison with other forms of wealth. Land returns are increasing more slowly than public expenditures and are inelastic.

Therefore, it is recommended that land should be used chiefly as a source of local revenue; that land taxation should be real estate taxation, owing to the difficulty of separating the value of the land and that of improvements, which in many cases become so blended that they are indistinguishable and inseparable.

arable; and that taxes should be in proportion to the selling value and not progressive. It is held that if regulation of the size of landholdings is needed, this should be brought about by other methods than by taxation. The author asserts his belief that not enough facts are known to warrant at this time an attempt to determine what is a proper economic holding, and that in any case regulation by taxation has no place at the present time in land ownership in the United States. A comprehensive cadastral and economic survey of the land of the country is urged. Further investigation is said to be needed with regard to the modification of the system of taxation of selling value of land in the direction of taxation of income value; systems of taxation in different States and different countries, with special reference to the rates of taxation on land; leasehold systems of land tenure; taxation of forest and mineral lands; and the theory and practice of indirect taxation.

A discussion by members of the association is appended (pp. 286-300).

An inquiry into the status of agricultural labor (*Enquête sur le Travail Agricole*, Brussels: Min. Agr., Admin. Agr. et Hort., Serv. Assoc. et Statis., 1920, pp. XXXI+880).—A summary report is made of the economic, social, and hygienic conditions of farm laborers in Belgium, including farm domestics boarded at the farm and laborers who cultivate small holdings of their own with the aid of members of their families. The appendix contains the detailed signed reports from each Province.

Business methods of marketing hay, G. A. COLLIER (*U. S. Dept. Agr., Farmers' Bul* 1265 (1922), pp. 25, figs 11).—Recommendations are made with reference to the marketing of hay by the consignment and the straight sales methods. The trade rules deemed important are set forth, and suggestions are made for the use of Government production and market reports in the study of the time and place of selling. The billing and invoicing of shipments are described in detail, as is also the collection of damage or loss claims.

Report to the Government of Saskatchewan on wheat marketing, J. STEWART and F. W. RIDDELL (*Regina, Canada: [Govt.], 1921, pp. 21*).—The system of wheat marketing at present in vogue in Canada under the provisions of the Canada Grain Act is briefly outlined. The question of complete State control of the marketing of the western wheat crop is considered to the conclusion that national control through such an agency as the Canadian Wheat Board would give advantages to the producer in the marketing of his wheat crop that could not be secured in a similar degree in any other form of centralized control. The question of the advisability of establishing a pooling agency based upon legal contract or voluntary effort is also developed. Various forms of pools are described. It is the opinion of the committee that in the event of the adoption of a pooling plan comprising less than the whole of the western wheat crop, a voluntary arrangement is preferable; and general principles are outlined, involving centralized selling, initial advances, and equal distribution of the proceeds of sales according to grade.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 2 (1922), Nos. 1, pp. 16, figs. 3; 2, pp. 17-32, figs. 4; 3, pp. 33-64, figs. 6; 4, pp. 65-80, figs. 2; 5, pp. 81-104, figs. 4).—These numbers offer notes on weather conditions, with temperature and precipitation charts, up to and including the week ended July 25. The usual tabulated weekly reports on prices and receipts in the market of important agricultural commodities are given, as well as special articles on local or outstanding market situations and foreign markets. Special articles in No. 1 give detailed data on the estimated value of farm products for 1921, also an estimate of the strawberry shipments to June 15, 1922, and comparisons with those of last season. The produce market at St. Louis is described, and a special report is made on cotton acreage

and condition in No. 2. Reports on the progress of the marketing of the season's hay crop and a forecast of corn and winter wheat production are included in No. 3. No. 4 contains a forecast of sugar-beet production and a summary of celery shipments from Florida; No. 5 a review of recent extensions in the Federal market inspection service for perishable farm products and a study of index numbers of the purchasing power of farm products by months in 1921 and 1922, with comparisons for earlier years. No. 3 also contains the July crop reports, including tabulated summaries of crop conditions, with comparisons and current reports on estimated farm value of important products and averages of prices received by producers.

National agricultural policy, R. F. CABIESES VALLE-RIESTRA (*Política Agraria Nacional. Lima: Equitativa, 1921, pp. X+120, pls. 2*).—This is a collection of articles on various phases of the improvement of Peruvian agriculture contributed by the author to periodicals during 1919 and 1920.

The situation of Belgian agriculture, A. DELOS (*Jour. Soc. Natl. Agr. Belg.*, 4 (1922), Nos. 11, pp. 81, 82; 12, pp. 89, 90; 13, pp. 98, 99; 14, pp. 106-108; 15, pp. 113, 114; 16, pp. 121, 122; 17, pp. 129, 130).—Three periods of agricultural development in Belgium are defined on the basis of crop returns. The years of 1840 to 1875 were marked by gradual increases in agricultural returns and land values. Between 1880 and 1895 there occurred a crisis due to the importation of American wheat, resulting in decreased prices for agricultural products and lower land values. The period of 1895 to 1910 was characterized by rising land values as a result of improvement in agricultural technique, association of producers, and restoration of old land values. The present economic situation with regard to land tenure and farm leases, returns from farming, wages of agricultural labor, and availability of capital is discussed.

French West Africa, its resources and economic organization, H. COGNIES (*L'Ouest Africain Français, ses Ressources Agricoles, son Organisation Économique. Paris: Emile Larose, 1921, pp. XXVI+253, pls. 23, fig. 1*).—A mission visiting points in Kamerun, Southern Nigeria, Dahomey, Togo, Gold Coast, Ivory Coast, and other colonies in northwestern Africa makes a report in these pages. The possibilities of cotton production, forest resources and conditions, and the organization of agriculture in general are set forth.

Rural institutions (*California Sta. Rpt. 1921, pp. 102-107*).—Certain activities and results obtained in the division of rural institutions are summarized by E. Mend. It is pointed out in what way the Durham and Delhi State land settlements in California have afforded opportunity for the improvement of agriculture and rural life along with the development of a rural community. Investigations that are being made, with special reference to problems of cooperative marketing and the financing of the distribution of California farm products, are noted.

AGRICULTURAL EDUCATION.

The Federal Board for Vocational Education, its history, activities, and organization, W. S. HOLT (*Inst. Govt. Research, Serv. Monog. U. S. Govt. No. 6 (1922), pp. XI+74*).—This is one of a series of monographs, which when completed will give detailed descriptions of the 50 or more distinct services of the Federal Government. It covers the history of the establishment and development of the board, its functions and organization, and the character of the plant. Appendixes contain an outline of organization, classification of activities, list of publications, laws, a financial statement, and bibliography.

Agricultural education in China, J. H. REISNER (*World Agr.*, 2 (1921), No. 1, pp. 97, 98, fig. 1).—Three types of agricultural schools in China are the agricultural college, the vocational agricultural middle school, and the higher primary agricultural school. The aims of schools of each of these types are briefly considered, and certain specialized schools and the educational work of missionary organizations are noted.

Agricultural instruction in the Dutch East Indies, T. J. LEKKERKERKER (*Het Landbouwonderwijs in Nederlandsch-Indië. Batavia: Dept. Landb., Nijv. en Handel*, 1921, pp. 30).—The aims and courses of instruction at the agricultural school at Buitenzorg, agricultural normal schools, and middle and lower schools are set forth.

A course of study in rural home economics at the Normal Rural Home Economics Institute (*Inst. Norm. Supér. Econ. Ménagère Agr., Laeken, Bul.* 29 (1921), pp. 45, figs. 22).—The royal decree of organization of the Institute, its opening at Laeken for school purposes, and the school buildings and farm are described, and an account is given of the visit of the Queen of Belgium. The character and scope of the work carried on at the school and other such matters are discussed.

Twenty-fifth and twenty-sixth reports of the German section of the agricultural advisory committee for Bohemia, 1916-1920 and 1921, T. ZULEGER ET AL. (*Ber. Deut. Sekt. Landesk. Rates Böhmen*, 25 (1916-1920), pp. 176; 26 (1921), pp. 84).—These cover activities of this body for the improvement of agricultural technique and live-stock raising and the spread of education in economics, including bookkeeping for agriculture.

Studies of occupations in agriculture, forestry, and animal industry, F. J. ALLEN (*Cambridge: Harvard Univ.*, 1921, pp. X+39).—This study is intended to present the importance, content, advantages and disadvantages, preparation necessary, income, and effect on the worker of 18 occupations connected with agriculture, forestry, and animal industry. It is especially designed for use in the junior high and high school and in agricultural schools and classes studying vocations.

Principles and methods of valuation, bookkeeping, and calculation in agriculture, E. LAUR (*Grundlagen und Methoden der Bewertung, Buchhaltung und Kalkulation in der Landwirtschaft. Berlin: Paul Parey*, 1922, 2. ed., pp. XVI+600).—The author declares his ambition for adding another stone to the foundation for agricultural bookkeeping. It is intended to present a discussion of fundamentals rather than a handbook. It is considered that the science of agricultural economics must be based upon accurate records for agricultural operations, and that these can not be kept properly without a knowledge of the nature, classification, valuation, and amortization of capital and the theory of cost of production calculations.

Part 1 of this edition is devoted to the definition, delimitation, and classification of agricultural capital. Eleven kinds of constituents are named and grouped into active and passive capital groups, the former including fixed capital (*Landgutskapital*) and movable (*Pflichterkapital*), with a number of subgroups under each. In the section on valuation of capital the author devotes several pages to a discussion of general principles, this being followed by a discussion of the valuation of each kind of capital. The other sections are treated in a similar manner.

Part 2 discusses the nature and principles of single and double entry bookkeeping. Illustrative examples are given, with particular attention paid to the advantages of the double-entry system for agriculture.

NOTES.

California University.—The dedication of the dairy industry and horticultural buildings at the university farm took place October 24. These buildings are the first of a group of permanent buildings which it is proposed to construct at Davis. Both are two stories in height and of concrete and hollow tile. The dairy industry building contains the director's offices and is equipped with modern machinery throughout. The horticultural building contains an auditorium seating 250 persons, in addition to classrooms, student laboratories, and research facilities.

The principal dedication addresses were made by Dr. W. H. Chandler, vice dean of research in Cornell University, President R. A. Pearson of the Iowa College, and Professor Emeritus E. J. Wicksen, President Barrows, C. L. Roadhouse, and C. B. Hutchinson of the university.

Iowa College and Station.—Spencer A. Beach, head of the horticultural department since 1905 and vice dean since 1906, died November 2. Professor Pench was born at Sumner Hill, Cayuga County, N. Y., in 1860 and was graduated from the Iowa College in 1889, receiving the M. S. degree in 1892. He had also served as professor of horticulture and botany in the Texas College in 1890 and 1891, and as horticulturist of the New York State Station from 1891 to 1905, preparing while at the latter institution the volume on the Apples of New York. As a part of his work in Iowa he had been instrumental in developing about a dozen promising new varieties of apples, and was the author of a number of well-known books on horticultural subjects.

Miss Anna E. Richardson, since 1918 chief of the Home Economics Education Service of the Federal Board for Vocational Education, has been appointed in charge of the division of home economics beginning January 1, 1923.

Massachusetts College and Station.—A new course for gardeners is being offered extending from September 27 to June 8, 1923. The course is being given in cooperation with the National Association of Gardeners with the object of combining the theoretical instruction characteristic of the American system of horticultural education with the practical or apprenticeship system, better known in Europe. The college will provide the theoretical and scientific phases of the work, and the association will make arrangements for practical employment on estates, etc.

Dr. James B. Paige, professor of veterinary science and head of the department in the college and station for many years, died on October 5, after an illness of about 18 months. Doctor Paige was born in 1861 at Prescott, and was graduated from the college in 1882. In 1888 he received the degree of doctor of veterinary science from McGill University and entered the service of the college the following year, first as lecturer and later as professor and head of the department. He was a clear and forceful lecturer and teacher and was largely responsible for the upbuilding of the veterinary work of the institution. Mainly through his efforts, an appropriation was secured in 1898 from the legislature for the erection and equipment of the present veterinary

laboratory. For a year he also served as dean of the college, for a number of years as secretary of the Associate Alumni, and for two years as a member of the State legislature.

G. Edward Gage, Ph. D., professor of animal pathology, has been appointed to succeed him in the college and station.

Michigan College.—H. H. Wedgworth has been appointed to the fellowship offered by the National Research Council on the economic uses of sulphur in relation to agricultural practices.

Minnesota University and Station.—Plans are being drawn for the new dairy building upon which it is expected to begin construction next spring. A 3-story main building with a 1-story rear addition and to cost \$220,000 is contemplated.

Charles Haralson, superintendent of the Fruit Breeding Station since 1907, has resigned, effective January 1, 1923. Miss Adele Koch, assistant home demonstration agent leader has resigned. Dr. W. A. Billings has been appointed specialist in veterinary medicine in the extension service.

Nevada University.—Dr. Philip A. Lehenbauer, assistant professor of plant physiology and assistant chief in plant physiology in the Illinois University and Station, has accepted a position as associate professor of biology.

North Dakota College and Station.—Dr. Alva H. Benton, since 1918 professor of farm management and agricultural economics at the Manitoba Agricultural College, has been appointed head of the department of marketing and rural finance. Lawrence R. Holland has been appointed instructor in dairy manufactures and in charge of this work in the station.

Ohio State University.—A six-year course in animal husbandry and veterinary medicine has been established. This course is designed to give more comprehensive training in animal husbandry than the regular veterinary course. It leads to two degrees, the B. S. in agriculture at the end of four years and that of D. V. M. at its conclusion.

Oklahoma College and Station.—Cooperative experiments in field crops are being conducted at four places in the State in connection with the district agricultural schools and other institutions. Definite arrangements have been made for starting such experiments in two other places, one at the U. S. Indian School at Chilocco and the other at the county farm in Tulsa County. In addition to these cooperative experiments in which nearly all of the main field crops are used, crop experiments with cotton are being carried on with 10 or 12 farmers.

The station mailing list is being revised. The county agents have sent in the names of some 200 to 300 leading farmers of their counties which will compose the farmer mailing list, and will aggregate about 15,000 names. It is the plan hereafter to send out postal cards announcing new publications. These publications will be sent to farmers and others requesting them—in other words, it is the plan to not broadcast the station publications.

C. E. Sanborn, head of the department of entomology, has been given leave of absence for a year for graduate work at the Kansas College. Carl P. Thompson has been given a similar leave of absence at the Iowa College, his work being taken by A. L. Anderson of that college. W. G. Friedemann has resigned as assistant chemist and has been succeeded by Willis D. Gallup. E. A. Miller, field agent in the Office of Extension, States Relations Service, U. S. Department of Agriculture, has been appointed head of the department of rural economics, beginning September 26.

Pennsylvania Station.—The title of I. D. Wilson has been changed from professor of animal husbandry to professor of veterinary science. George

Kernohan, D. V. M., has been appointed instructor in bacteriology, effective October 3.

Porto Rico Federal Station.—L. G. Willis resigned as chemist September 16 to become soil chemist in the North Carolina Station.

Porto Rico Insular Station.—A modern cattle stable is being built at a cost of about \$4,000. Recent appointments include R. Menéndez Ramos as director, M. Gorbea Plá as chief chemist, and Ignacio L. Torres as horticulturist. Jean P. Griffith, the former horticulturist, has been appointed plant breeder, succeeding P. Richardson Kuntz, who has been made chief agronomist. C. E. Chardón, special pathologist, has been appointed expert in cane diseases.

Virginia Truck Station.—Dr. Herbert Spencer, assistant professor of entomology and zoology in the North Carolina College and subsequently of the department of entomology and zoology of the Ohio State University, has been appointed associate entomologist in charge of investigations of insects affecting truck crops.

Wyoming University and Station.—Plans have been decided upon for a combined veterinary and parasitology building. A course in poultry has been added to the curriculum of the College of Agriculture, and plans are under way for a poultry building.

Poultry Work in Palestine.—J. L. Kramer, a graduate of the Baron de Hirsch Agricultural School and the University of Nebraska, has been appointed in charge of the newly established poultry department of the Palestine Agricultural Experiment Station at Tel-Aviv, Jaffa, concerning which a note was recently published (*E. S. R.*, 46, p. 798). A model poultry farm is to be established in Ben-Shemen as the center for poultry instruction, and considerable extension work will also be undertaken in an effort to build up the poultry industry in Palestine. Breeding stock is being selected in Europe, and some of the equipment is being contributed by incubator companies and other manufacturers in this country.

Miscellaneous.—A recent issue of the *Journal of the Ministry of Agriculture* of Great Britain calls attention to an unusual feature of the conferring of honorary degrees by Cambridge University last June in that six of the nine recipients were known especially for their services to agriculture. Among these were Sir Daniel Hall of the Development Commission, A. E. Humphries associated with Prof. R. H. Biffen in wheat improvement, and E. S. Beaven, a breeder of improved barleys.

Charles Crowther has been appointed principal of the Harper-Adams Agricultural College at Newport, Salop, vice P. Hedwirth Foulker, who has been at the head of the institution since its establishment in 1900. R. M. Wilson, principal of the East Anglian Institute of Agriculture, has been appointed principal of the South Eastern Agricultural College at Wye, and has been succeeded by H. M. McCreath, head of the agricultural department, Seale-Hayne College, Devon.

W. D. Clayton, the first county agent in the United States whose salary was paid in part from public funds contributed by a county, died August 17. Mr. Clayton was a graduate of the Alabama Polytechnic Institute and was originally appointed a county agent in Adams County, Miss., in 1908. At the time of his death he was serving as county extension agent in Orleans Parish, La.

Dr. D. I. Andronescu of Emerson, N. J., has accepted a position with the Department of Agriculture of Rumania as chief of the department of plant breeding and with headquarters at the Agronomic Station at Baneasa-Bucharest.

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Assembling in Washington for the first time since the entrance of this country into the World War, the Association of Land-Grant Colleges held its thirty-sixth annual convention from November 21 to 23, 1922. The great changes which have characterized the five-year interval, a period of exceptional interest and importance to agricultural education and research, were reflected in the personnel, the program, and the policies of the convention.

The unique position of the Capital City as a place of meeting for representatives of a national system of education with many close relations with the Federal Government was again demonstrated. Official recognition of the association was shown in a reception tendered the delegates by President Harding. The Secretary of Agriculture, the Assistant Secretary, the Director of Scientific Work, and other members of the Department's staff, as well as representatives of the War Department, the Department of Commerce, the U. S. Bureau of Education, and the Federal Board for Vocational Education were participants in the program. Members of the engineering section made visits of inspection to the navy yard and the laboratories of the Bureau of Public Roads. The mutual benefits of contacts such as these were well set forth by the Secretary of Agriculture in his address of welcome.

Although many faces familiar a half decade before were missing, the convention attendance was quite large and representative. The registration exceeded 200, and included delegates from every State except Arizona. The number of experiment station directors reached 41, but only 31 institutions sent their presidents, many of the leading members of the group being thus unrepresented in the executive body. That the constitutional provision restricting participation in this body to the heads of institutions has proved ineffective as a means of securing the attendance of the presidents at the conventions was virtually recognized by an amendment adopted at this meeting permitting the designation of substitutes.

The program of the association followed closely the plan at the 1921 meeting at New Orleans, with general sessions on two evenings and the final morning, two meetings of the executive body and an informal conference of presidents, and two-day programs of the

sections of agriculture, home economics, and engineering. The section on agriculture held parallel half-day sessions of its divisions of resident teaching, experiment stations, and extension, and three joint sessions dealing with questions pertaining to the interests of each of the divisions in turn. On the whole, the arrangements seemed to meet with general satisfaction, the most serious disadvantages apparently being the overlapping of portions of the sectional programs with the executive body and of all the sections with the final day's program of the American Society of Agronomy.

The number of organizations meeting in conjunction with the association was considerably smaller than at the Washington sessions of the past. However, the Association of Official Agricultural Chemists and the Association of Feed Control Officials met previous to the convention, and the American Society of Agronomy and the American Association for the Advancement of Agricultural Teaching during convention week. A new undertaking was a spring wheat conference preceding and a cotton conference following the convention, in which representatives of the land-grant colleges from the several States and of the U. S. Department of Agriculture participated.

The convention program gave many evidences of careful planning, and interest was well sustained throughout the sessions. Special efforts had been made to complete the assignments and send out the programs well in advance, practically every speaker was in attendance, and the number of changes necessitated was unusually small.

In the enforced absence of the president of the association, President T. D. Boyd of Louisiana, the general sessions were presided over by the vice president, Dean A. A. Potter of Indiana, and the presidential address was also given by him. Dean Potter took for his subject *Tendencies and Problems in Land-Grant Institutions*. He advocated increased financial support for the agricultural experiment stations and the rapid development of engineering experiment stations and engineering extension departments, but cited as the great opportunity of the land-grant institutions for service to society the training of their thousands of students. The need of specific attention to character building, promoting clear and correct thinking and careful guidance in the choice and methods of study, a higher valuation of good teaching, and greater attention to the above-average and below-average type of students were among his recommendations. He also suggested that the association should investigate the feasibility of additional courses for prospective leaders, and advocated that graduate courses with this purpose in view should be fostered by at least the stronger institutions.

The address of Secretary Wallace dealt primarily with some of the novel economic questions arising in connection with the read-

justment necessitated by the present agricultural depression. Among these he cited the advance in railway rates, and the coming of a new epoch in American agriculture under which the profits of farming must be sought from what is produced and not from an increase in the value of land, and he pointed out that "unless we can get our agriculture upon a fairly prosperous basis, one year with another, offering opportunities fairly comparable with the opportunities in other lines of endeavor, we may expect that our boys, our young men, will steadily drift from the farms into the cities." He noted the wide concern for the prosperity of agriculture being evinced by business interests, not in the paternalistic spirit sometimes encountered before the war, but based on a desire to help because of the realization that their own interests depend upon getting agriculture once more upon a prosperous footing.

The Secretary went on to commend the larger emphasis being put on agricultural economics in agricultural teaching, and he explained the reorganization of the department in this direction, especially the consolidation of the Bureaus of Markets and Crop Estimates and the Office of Farm Management and Farm Economics into the Bureau of Agricultural Economics. The recent formation within the Department of "commodity councils" for the coordination of the various lines of work and the formulation of a definite departmental program as to cotton, wheat, and other commodities was referred to, and the possibilities of further developments through cooperation with the States in both commodity and regional councils were suggested. He spoke appreciatively of the cordial relations enjoyed with the land-grant institutions, and expressed the hope that even more complete cooperation in research would be found feasible.

The economic situation was also dwelt upon in the address of President John R. Howard of the American Farm Bureau Federation, who found in what he called the new period of permanent development or adaptation a challenge to the land-grant institutions to prepare their graduates to cope with the difficult problems of transportation, agricultural credit, and marketing, and for the upbuilding of constructive citizenship. From a survey of college catalogues he voiced the belief that too much attention is given, relatively, to the study of material subjects and too little to those dealing with human relationships. On the whole, however, he commended most heartily the work of the colleges and particularly that of the experiment stations, advocating for them more liberal financial support.

The enlarging interest of this country in world affairs was reflected in the devotion of two full sessions to a discussion of conditions abroad. One of these, for the section on agriculture as a whole, dealt with some economic aspects of the world agricultural situation, the principal changes in European production and consumption and

their consequences being depicted by Prof. E. G. Montgomery of the U. S. Department of Commerce. He showed that the European farmer has had many difficulties to contend with, including uncertainties as to legislative policies of price fixing, tariffs and embargoes, and land tenure, as well as impaired credit facilities because of falling exchange; and he characterized the Continent to-day as a vast experimental field from an economic viewpoint, and one in which the American farmer is vitally interested.

A second session was given over to a symposium on agricultural education and research in foreign countries. This was participated in by four speakers, all on the basis of recent personal observations abroad. It was opened by Dr. G. F. Warren of Cornell University, who discussed the general subject of Agricultural Economics in Europe. He was followed by Dr. J. G. Lipman of New Jersey, who dealt with agricultural institutions in Czechoslovakia, Prof. W. H. Stevenson of Iowa, who considered mainly the progress of the International Institute of Agriculture at Rome, and President K. L. Butterfield of Massachusetts, who took up agricultural education and research in China and Japan.

In a paper replete with reminiscence of his long period of service, Dr. W. H. Jordan addressed the general session with his subject *After Fifty Years*. The early history and difficulties of the land-grant colleges were retold, from the pioneer days to the "development of colleges and universities firmly established in the respect and confidence of the people, whose incomes extend into millions and whose students are numbered by thousands," and with the aggregate result "a notable achievement in education and a tribute to the faithful service of a great body of educators."

Dr. Jordan, however, cautioned that "size and popularity are not sure signs of a wise educational program, nor do they provide an escape from insistent problems." Among the present-day difficulties he cited the system of fiscal administration in certain States whereby, because of the rigid limitations imposed, administrative authority of the college and station has been virtually transferred to fiscal bureaus at the seat of State government. It is of interest to note that a thorough study of this matter was authorized by the executive body.

The changing economic and political status of agriculture was also dwelt upon by Doctor Jordan, who pointed out that "agriculture is adventuring in the domain of great problems, and its followers may not be expected to recede from their purpose to promote and defend their fundamental interests, and their fundamental interests are fully as closely related to their social environment and to financial and marketing conditions as to technical methods. The question of leadership thus comes to the fore." It was insisted that the agricultural

colleges should agree as to what they should accomplish to prepare students for future leadership, and he advocated that "specific and severe mental toil should now be imposed in those subjects related to agriculture such as the principles of government, the sociology of rural life, the economics of agricultural production and distribution, the organization and methods of finance and business relations, not neglecting the idealism of individual and community life." He contended that "to absorb the time of a mentally capable undergraduate to any considerable extent with corn judging, cattle judging, judging at fairs, pruning trees, picking and packing fruit, and butter and cheese making is cheating him out of his intellectual rights and privileges, and is to that extent a failure to give him the best possible college preparation for an efficient service in agricultural affairs." This view, he made plain, should not be regarded as antagonistic to vocational education, but rather as the expression of a conviction that the four years of college life are set apart for developing high ideals, intellectual vision, and imparting fundamental knowledge, a period not to be invaded by the simple details of practice.

These views reflect the higher standards and conceptions of agricultural education which are increasingly being reflected in the courses of instruction. They represent a very radical change, even in quite recent years. They are a product not only of the changed economic and other conditions affecting the agricultural industry, but are in a sense a product of the work of the colleges themselves. The awakening to a broader vision and the inauguration of larger efforts for self-help among rural people which have followed the teaching of agriculture and the inculcation of research have presented the whole subject in a different light. No more striking illustration of the changed attitude of the farming people themselves could be found than in the remarks of the spokesman for the largest farm organization already referred to.

That these continue to be live matters was shown by the attention given to improvement in both subject matter and teaching methods by the section of resident teaching. A notable contribution as to aims and organization was made by Dean A. R. Mann of Cornell University, who stated that the discovery and application of the proper aims in higher education is probably the most insistent and neglected problem now confronting the colleges and universities of America. He advocated a detailed study by the colleges of agriculture of the broad questions of the major aims on the basis of public policy, the relationships of other departments of knowledge, the nature and range of life pursuits of graduates and nongraduates, and the prospective activities and openings in the future. On the basis of the survey, a job analysis of the various divisions of the field

should be attempted from the standpoint of the field itself and the individual student, followed by a determination of the organization of curricula as regards the field, the student, and the institution, the content and organization of the subject courses of instruction, and the methods of teaching appropriate to the respective subject courses. In his opinion the great need of to-day is "the correlation of the work of the specialists so as to obtain unity in the curriculum, cumulative worth, and controlled direction toward intelligently determined objectives."

The discussion that followed indicated a growing belief on the part of the colleges that the time has come for careful consideration of policies and objectives along the lines suggested by Dean Mann. This in no sense implies a confession of failure but is rather a consequence of remarkable achievement, a realization that the days of pioneering in agricultural education are at an end, and that with the experience of the past as a guide the way is now open as never before for the upbuilding of a permanent educational structure.

The aims, purposes, and credit value of laboratory work were discussed by Dean R. L. Watts of Pennsylvania, who drew attention to the emphasis placed on this type of instruction by the land-grant colleges as a means of developing an inquiring mind. Among the advantages of laboratory work he mentioned the opportunity for teaching principles, developing the power of reasoning, encouraging manipulative skill, and stimulating interest and enthusiasm. He also advocated the more general assignment of specific problems, especially to the more advanced students, stating that "every graduate should have the investigational spirit and be eager to increase his knowledge of matters which will enrich his own life and make him a more useful citizen," and that "if more of our undergraduates learned the fascination, the satisfaction, and the real compensation of investigational work, there would not be such a dearth of well-trained scientists who desire to choose research as a life career."

The committee on instruction in agriculture, home economics, and mechanic arts, reporting through Dr. A. C. True, continued its study of college teaching in these branches by a specific inquiry as to methods for the professional improvement of teachers while in service. It will perhaps be surprising to many to learn that all the land-grant colleges now have departments that offer courses in psychology, methods of teaching, and other professional studies for teachers, and that many also offer methods courses in agriculture and home economics. Some of these courses are not available to resident teachers in service, but few institutions were found whose professional improvement courses were necessarily unattainable provided the present heavy teaching load could be readjusted. Indications were seen of a more sympathetic attitude on the part of administra-

tive officers and an increasing disposition to consider professional training as well as technical experience in making appointments.

As usual, the committee presented numerous constructive recommendations. It proposed that the association declare itself in favor of professional training for college teachers, and that the several institutions make particular efforts to improve their methods of teaching and encourage their staffs in this direction. The development in colleges having strong departments of education of graduate courses and summer instruction was also suggested, and the belief was expressed that these departments should become more widely service departments in connection with the institution's own instruction work as well as training departments for teachers in general. The employment of experienced and successful teachers to have charge of and take part in teaching introductory and basic courses was advocated, as well as a requirement that beginning with 1925 candidates should be required to have had at least six semester hours of professional training.

The customary bibliographical report, also presented by Dr. True, took the form of a selected list of references on the preparation and use of illustrations, and was designed to assist educators in agriculture and home economics to make the most effective use of illustrations as a supplement to the written word. This material included 100 titles, of which 40 dealt with general photography, 11 with photography in relation to the natural sciences, 23 with motion pictures and lantern slides, 11 with graphic methods, 7 with the preparation of illustrations for publication, and 8 with periodicals on photography and motion pictures. Attention was drawn to the increasing use of illustrations in educational work and the great improvement in quality of the material constituting this form of instruction within the past four or five years.

The papers dealing directly with the work of the experiment stations were numerous and timely. The program of the station section was opened with a suggestive discussion by Dr. H. H. Love of Cornell University on the Application of Probable Error to Agricultural Experimentation. In this paper were analyzed the results reported from various institutions to illustrate how determinations of this factor, if carefully applied, may aid in interpreting results, checking up the value of certain kinds of data, and serving as a guide in planning future work. The inclusion on a station staff of at least one member trained in biometrics was recommended to assist in such determinations. This paper was effectively supplemented by a symposium of the American Society of Agronomy on the application of statistical methods to the results of field tests, and was indicative of the widespread interest now manifested in increasing the precision of methods of experimentation.

The relation of the stations to the graduate work of the college was considered by Dr. E. W. Allen of the Office of Experiment Stations and Dr. E. C. Johnson of Washington, the latter presenting the results of a questionnaire from which replies were received from 41 institutions. The consensus of opinion seemed to be that the well-being of the station itself should govern its participation in graduate instruction, and that while in general the employment of graduate students held many advantages, "the number working under any one investigator should be small, the quality high, and the amount of station funds used in this way limited or the progress of the station will suffer in consequence."

A number of important research problems were considered by Dean F. B. Mumford of Missouri, including the training of research workers and the importance of a sympathetic understanding of research by administrative officers. The specific question of a favorable environment was dealt with by Directors S. B. Haskell of Massachusetts and T. P. Cooper of Kentucky, and that of points to be considered in cooperation in research by Dr. E. D. Ball, Director of Scientific Work in this Department, and Dean H. W. Mumford of Illinois.

In a paper entitled the Future of Agricultural Experiment Stations, Doctor Jordan cited, on the basis of results obtained in the State of New York, some of the outstanding achievements of scientific research in agriculture which have contributed materially to the welfare of country and city, and indicated the large returns realized from the expenditure of comparatively small amounts of State and Federal funds. He maintained that "because the experiment stations deal with the problem of food production and use, and with encouraging success, the claim that these institutions are more essential to national welfare than any other enterprise supported by public funds can not be successfully controverted. They develop basal knowledge, they are a constructive effort, they deal with conserving of resources in the most fundamental way." As regards the future, the essential requirements were held to be men and means, the securing of individuals with strong research impulses and ideals and the needed mental equipment on the one hand, and adequate financial backing from the State and Nation on the other.

The joint committee on projects and correlation of research, reporting through its chairman, Dean Mumford of Missouri, reaffirmed its belief that the association should favor a closer correlation of research between the State and Federal Government. The committee on the publication of research recounted the happenings of the year as regards the *Journal of Agricultural Research*, and announced the resumption of publication of this periodical to begin January 6,

1923. The report of the committee on station organization and policy, presented by Director Thatcher of New York and dealing with the desirability of a general plan or program for the activities and development of each individual station, has been discussed editorially in the November issue of the *Record*. It is hoped to take up in greater detail in a subsequent issue some of the other matters of interest to research brought out in the various papers and reports here briefly referred to.

An increasing interest in research was also demonstrated at several points outside the program immediately relating to the stations. For instance, a paper by Director G. I. Christie of Indiana was given before the extension division on the Function of Research Departments in Determining Extension Programs, in which close coordination of the work of the station and extension forces was deemed vital. The opinion was expressed that "one of the best things extension workers can do is to join hands with the experiment station workers and lend them every support. They should emphasize the work of the research departments of the institutions and the U. S. Department of Agriculture. It means much to have extension teachings backed by results of careful, worth-while investigations. The greatest agricultural fort is a strong active experiment station. Extension work carried on independent of the experiment station will not go far or mean much, but extension work that is guided by facts derived from research will build a strong and permanent agriculture."

The engineering and home economics divisions each set aside a half day's session for research matters. The principal paper in the former group was presented by Dr. R. S. Woodward, formerly president of the Carnegie Institution of Washington, on the Varied Aspects of Research, in which the whole question of research and research institutions was broadly presented.

The program of the home economics division included a report of its committee on standards of research, a discussion of the organization of facilities for research from the point of view of administration, suggestions as to the publication of research findings, and a paper by Miss Mary E. Matthews of Indiana, summarizing the provisions now being made by departments of home economics to promote research, as indicated by replies to a questionnaire received from 32 institutions. From this it appeared that at least 16 institutions are now carrying on research in this field, although only three, the Colorado College, Purdue University, and Cornell University, have full-time workers. Of these the first two are receiving station funds. In a number of institutions increasing provision is being made for graduate instruction, in recognition of the great

need for more definite standards and the development of courses specially devoted to the training of prospective investigators. Evidences were not wanting that, despite the relative lack of funds and other difficulties, a distinct gain has been made in the past few years from the research point of view.

Contrary to the custom of recent years, a definite decision was announced as to the time and place of the next meeting, these being set for Chicago from November 13 to 15, 1923. The presidency of the association was bestowed upon President Howard Edwards of Rhode Island, with Dean Burnett as vice president. The secretary-treasurer and all members of the executive committee were continued unchanged. A complete list of the officers and committee changes is given in the notes in this issue.

The 1922 convention was an interesting gathering, although the removal of most business matters from the open sessions has considerably changed its appearance and program from that of former days. The pressing questions, so far as the public could observe, centered around the economic situation of the country and the responsibility of the land-grant colleges to train men to meet it, the need of further strengthening the resources available for research, and the possibilities of increased cooperation between institutions. On all these matters an enlightened stand was taken, and it would appear that progress is being made toward their more complete accomplishment.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The colloidal behavior of edestin, D. I. HITCHCOCK (*Jour. Gen. Physiol.*, 4 (1922), No. 5, pp. 597-615, figs. 8).—The globulin edestin has been shown by titration experiments to react stoichiometrically with acids and bases, thus confirming Loeb's theory that proteins are amphoteric electrolytes (E. S. R., 44, p. 501).

The composition of soy bean oil, W. B. SMITH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 530, 531).—Data are given on the composition of four samples of soy bean oil from different sources. From these data it is concluded that the composition of soy bean oil having an iodine number of 134 is approximately as follows: 2 to 3 per cent linolenic, 55 to 57 per cent linolic, 26 to 27 per cent oleic, and 9 to 10 per cent saturated acids.

Animal and vegetable fats and oils, W. L. AUSTIN and H. J. ZIMMERMAN (*Washington, D. C.: Bur. of the Census [U. S.], 1922, pp. 16*).—The statistics given in this report cover the factory production and factory consumption in the United States of animal and vegetable fats and oils by three-month periods during 1919, 1920, and 1921, and the factory and warehouse stocks at the end of each quarter during these years.

The flower and the organic chemist: Perfumes, natural and synthetic, M. T. BOGERT (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 359-364, figs. 2).—In this lecture the author traces the history of the use of perfumes, and describes briefly modern processes for obtaining essential oils and other odoriferous constituents of plants.

A study of the action of churning on human and cow's milk, H. BEHRENDT (*Biochem. Ztschr.*, 123 (1922), No. 4-6, pp. 450-464).—The greater tendency of human milk than of cow's milk to sour on churning is attributed to the higher lipase and fat content of the former. The process of churning is thought to hasten the action of lipase on the fat with the formation of fatty acids which cause the milk to sour.

The significance of the medium in the study of catalase, U. SAMMARTINO (*Biochem. Ztschr.*, 126 (1922), No. 5-6, pp. 179-188, figs. 12).—This paper gives the experimental data in proof of the statement noted in another contribution (E. S. R., 47, p. 664) that in alkaline solution vitamin extracts appear to stimulate, and in acid solution to retard catalase action.

The physical properties of commercial arsenates of lead, R. H. ROBINSON (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 313-317, figs. 3).—A study has been made at the Oregon Experiment Station of the physical properties of 12 brands of commercial lead arsenate collected in the open market in 1920.

No relation was found to exist between the specific gravity and the dry volume of the different samples. The samples which yielded the best suspensions in water were found to contain harmless deflocculents. Microphotographs of drops of suspensions of different samples also showed that in those containing deflocculents the particles are smaller, uniform in size, and tend

to form an ideal film, while those without spreaders are grouped in irregular clusters or tend to run unevenly to one side. It is pointed out that the latter, when used as sprays, would be washed off quickly by the continued action of rain and heavy dews, while brands containing a deflocculent would offer less resistance and consequently tend to adhere longer to the surface covered.

It is emphasized, however, that a deflocculent or spreader would be of no benefit if the particles are large and granular. If most of the particles of a lead arsenate containing a deflocculent settle immediately while there is just sufficient in suspension to obscure its real physical condition, such an arsenate will not be as efficient as another with better physical properties and having no spreader. The practical efficiency of any deflocculent or spreader that may be added to a commercial lead arsenate can best be determined by a comparison of the results obtained in field practice where ordinary care only is exercised in the application of the spray.

The electrolytic preparation of arsenate of lead. H. V. TARTAR and G. G. GRANT (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 311-313) —It has been found possible to obtain lead arsenate having satisfactory proportions of basic and acid salts by an electrolytic process in which the electrodes are lead and the bath a solution of sodium chlorate of from 1 to 2 per cent concentration and arsenic acid of 0.05 per cent concentration. The conditions most suitable for the electrolysis require a current density of from 1.25 to 1.875 amperes per square decimeter and a distance between electrodes of from 2.5 to 5 cm. The proportion of acid arsenate may be increased by allowing the precipitate to stand for several days in contact with the 0.05 per cent arsenate.

Chemical analyses with membrane filters.—III. The use of membrane filters in analyses by titration, G. JANDER (*Ztschr. Anal. Chem.*, 61 (1922), No. 4-5 pp. 145-171, figs. 2) —In continuation of previous work (E. S. R., 46 p. 614) examples are given of the applicability of membrane filters in methods involving titration as well as in straight gravimetric procedures. Illustrations given include the determination of difficulty soluble oxalates, manganese in manganese compounds and chromic acid in the presence of other oxidizing substances.

A simple method of electrometric titration in acidimetry and alkalimetry. P. F. SHARP and F. H. MACDOUGALL (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 6, pp. 1193-1196, fig. 1) —Using electrodes of from 12 to 12.5 per cent lead amalgam and lead iodid and from 12 to 12.5 per cent cadmium amalgam, the authors have prepared a number of half cells which are electrometrically equivalent to hydrogen electrodes in solutions in which the H-ion concentrations range from pH 4 to pH 10. In using these electrodes to titrate an unknown acid solution to an end point of a definite H-ion concentration, the half cell containing a hydrogen electrode and the unknown solution is connected with one of these electrodes and alkali run into the unknown solution until a galvanometer indicates a zero e. m. f. The method is considered to be of general application to all cases in which the correct potential difference at the electrode in the solution at the end of the titration is known in advance.

Some practical aspects of hydrogen electrode measurements. P. E. KLOPSTEG (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 399-406, figs. 8) —This paper, which has been presented before several sections of the American Chemical Society, consists of a concise description of the principles of H-ion concentration and its measurement, with general suggestions as to the selection and testing of the apparatus required.

The application of ion concentration measurements to the control of industrial processes. E. A. KEELER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 395-398, figs. 11).—Descriptions with diagrams are given of several

new types of electrodes for H-ion concentration determinations particularly adapted for industrial work. As illustrative of the many possible applications of ion determination methods, several curves obtained with H-ion recorders in different industrial problems are reproduced. These contain records obtained in the carbonation of beet sugar juice, the neutralization of pineapple juice, the changes in alkalinity occurring when tooth paste goes into water solution, and the alkalinity of wool-scouring liquor.

Simple hydrogen generator for use in making hydrogen-ion concentration measurements, P. H. CATHCART (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, p. 278, fig. 1).—In the apparatus described the hydrogen is generated by the electrolytic decomposition of a 10 per cent solution of sodium hydroxid, the cathode being located within a bell jar inverted in a cylinder containing the sodium hydroxid and provided with a glass outlet for the removal of the hydrogen. Whenever the reservoir becomes full and overflows a switch in the circuit is opened and the generation of gas is stopped until again needed.

The H-ion concentration of soils as affected by drying, P. S. BURGESS (*Science*, n. ser., 55 (1922), No. 1433, pp. 647, 648).—Data are reported from the Rhode Island Experiment Station on the H-ion concentration of 14 soils varying in reaction from pH 4.36 to pH 7.78, when fresh, dried in the air, and dried in the oven at 103° C. The determinations were made by the gas chain electrometric method originally proposed by Hildebrand and later modified for soil work by Sharp and Hoagland (*E. S. R.*, 36, p. 117).

The data indicate that drying acid soils, either at room temperature or at 103°, has but little effect on their H-ion concentration, although there appears to be a tendency toward slightly increased acidity at the higher temperature. Drying alkaline soils renders them decidedly less alkaline, especially if a temperature of 103° is used. Drying has practically no effect on an exactly neutral soil.

The determination of bromid in brines and mineral waters, C. C. MELOCHE and H. H. WILLARD (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 422-425, fig. 1).—The method, which is said to be suitable for the accurate quantitative determination of small amounts of bromid in the presence of large amounts of chlorid, is summarized as follows:

"The sample of brine, somewhat diluted if necessary, is treated with an excess of permanganate and hydrochloric acid, heated, and the bromine removed by means of a current of air. The bromine, together with some chlorine, is absorbed in sodium hydroxid solution, reduced to bromid and chlorid, preferably by hydrazin sulphate, acidified with nitric acid, and precipitated by means of silver nitrate. The weight of bromine is calculated from the loss in weight of the mixed silver halids on ignition in chlorine."

The action of hydrogen peroxid on the decomposition of plant and animal substances, HEUSS (*Ztschr. Gesam. Brauer.*, 1922, No. 6, pp. 44-46).—Hydrogen peroxid is suggested as a suitable agent for hastening the Kjeldahl process and at the same time prevent foaming. The directions for its use are as follows:

Five gm. of the substance and 1 drop of mercury are placed in a Kjeldahl flask with 25 cc. of 30 per cent hydrogen peroxid. After the mixture is shaken well 40 cc. of concentrated sulphuric acid is cautiously added in a thin stream. After the stormy reaction is over, the dark-brown liquid is heated for 15 minutes over a free flame, from 15 to 20 gm. of potassium sulphate is added, and the heating continued until the liquid is clear, which generally requires from 25 to 30 minutes. The solution is then diluted and the ammonia distilled off as in the usual method.

The analysis of solutions of ammonium citrate, C. S. ROBINSON and S. L. BANDEMER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 429-432, fig. 1).—An examination of the reliability of various methods of determining the ratio of ammonia to citric acid in ammonium citrate is reported from the Michigan Experiment Station. The methods studied were (1) the original technique of McCandless, in which the ratio of ammonia to citric acid is determined by adding a measured amount of $N/4$ alkali to the citrate solution, distilling off the ammonia into $N/2$ acid, and titrating the excess acid with $N/2$ alkali; (2) the same technique, but with $N/10$ reagents throughout; (3) the same technique as (2), except that the addition of acid was continued until the solution was acid to methyl red; (4) direct titration to a phenolphthalein end point with $N/2HCl$, after the addition of 35 cc. of $N/2NaOH$; and (5) the formaldehyde method with $N/10$ reagents.

Methods 1, 3, and 5 gave results agreeing fairly well, while the second and fourth methods gave wide variations. These are attributed to the difficulty in determining the exact end point in the final reaction, due to the fact that on approaching the end point from the alkaline side a pseudo end point is reached at which the color of the indicator disappears while the solution is still alkaline. Using methyl red as an indicator, the proper reaction to be passed in the addition of acid can be determined and the reverse titration made with phenolphthalein. The success obtained with the original technique is attributed to the strong acid used, which gave the necessary excess. It is concluded that when properly carried out the formaldehyde titration method and method 3, as noted above, can be relied upon to give results which represent accurately the composition of the solutions upon which they are used.

Quantitative determination of minute quantities of phosphates in biological products by the cerulean molybdc method, G. DENIGES (*Compt. Rend. Soc. Biol. [Paris]*, 84 (1921), No. 17, pp. 875-877).—Various details in the technique of the method of determining traces of phosphorus quantitatively by the use of the color reaction previously described (*E. S. R.*, 44, p. 611) are presented. The author proposes to call the method the cerulean molybdc method on account of the deep blue color of the phosphomolybdc compound formed.

Note on a possible source of error in the Bell-Doisy method for the determination of phosphates in blood plasma, W. DENIS and L. VON MEYSENBUG (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 1-3).—The authors present evidence that the occasional failure of color development in the Bell and Doisy method of determining phosphates in blood plasma (*E. S. R.*, 44, p. 613) is due to the presence of an excess of oxalate or citrate in the plasma. The restriction of the amount of oxalate or citrate, and the uses of larger amounts of molybdc acid and hydroquinone, as suggested by Myers and Shevsky (*E. S. R.*, 46, p. 506), are recommended where plasma must be used, but it is considered desirable whenever possible to make the determinations of inorganic phosphates only on the serum.

A method for the quantitative estimation of minute amounts of gaseous oxygen and its application to respiratory air, H. M. SHEAFF (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 35-50, figs. 2).—An apparatus and method have been devised by means of which it is said to be possible to make accurate measurements of small amounts of oxygen by running the measured sample of the air into an excess of nitric oxid in the presence of sodium hydroxid solution, comparing colorimetrically the nitrite thus formed with a known quantity of nitrite, and reading off the comparison as grams of oxygen on an empirical curve established by the same procedure with known quantities of oxygen. The

method is said to be sufficiently delicate to measure less than 0.1 cu. mm. of the gas.

Actual methods of analysts employed in the municipal laboratory of Paris and papers on matters relating to nutrition.—I, **Animal products and preserved foods**, edited by A. KLING (*Méthodes Actuelles d'Expertises Employées au Laboratoire Municipal de Paris et Documents sur les Matières Relatives à l'Alimentation. I. Produits Animaux Conservés.---Saisons et Produits Conservés. Paris: Dunod, 1921, pp. VIII+326, pls. 8, figs. 41*).—This volume combines the features of a reference book on animal foods and food preserves and a laboratory manual on the analysis of the various products discussed in the theoretical section. The subjects treated and their authors are as follows: Milk, by A. Kling; Cheese, by M. Pons; and Meat and Food Preserves and Preserved Products, both by J. Froidevaux.

The determination of carbon dioxide in self-rising flour, B. R. JACOBS (*Jour. Indus. and Engin. Chem., 14 (1922), No. 5, pp. 419, 420, fig. 1*).—The method described is an adaptation of the Truog method, involving the absorption of carbon dioxide by barium hydroxid and titration of the excess of $\text{Ba}(\text{OH})_2$ (E. S. R., 34, p. 504).

The flour is treated with a diastase solution, first at about 70° C. for about 10 minutes and then at boiling temperature. The CO_2 evolved is collected in a flask containing the starch and provided with an absorption tower which prevents contamination with atmospheric CO_2 . When the determination is completed, barium hydroxid is titrated with hydrochloric acid to the permanent disappearance of the last traces of the pink color of the phenolphthalein indicator. The carbon dioxide thus determined is assumed to be available carbon dioxide.

If it is desired to determine the residual carbon dioxide, 5 cc. of concentrated hydrochloric acid is added to the flask containing the sample. The solution is brought to a boil and boiled gently for 25 minutes, the carbon dioxide being collected in barium hydroxid as before.

Determination of esters in imitation flavoring extracts, G. F. BEYER (*Jour. Indus. and Engin. Chem., 14 (1922), No. 4, pp. 324, 325*).—A study of different methods of determining the ester content of imitation flavoring extracts has led to the adoption by the U. S. Bureau of Internal Revenue of the following technique:

The extract in 10 cc. amounts, or 5 cc. if it contains as much as 5 per cent ester calculated as ethyl acetate, is added to 100 cc. of 50 per cent ethyl alcohol in a 500-cc. Erlenmeyer flask. The flask is connected by a gooseneck with a vertical condenser, the end of which is fitted with a rubber stopper carrying a mercury valve and attached to a 100-cc. Kohlrausch flask. The solution is distilled slowly until 100 cc. of the distillate is collected. This is transferred to a 500 cc. Erlenmeyer flask and neutralized to the first pink color with phenolphthalein, an amount of $\text{N}/10$ sodium hydroxid 25 per cent in excess of the amount necessary for saponification is then added, the flask is stoppered tightly and allowed to stand overnight at room temperature, heated for one-half hour on a steam bath with a reflux air condenser, cooled rapidly, and titrated with $\text{N}/10$ acid. A blank determination is carried out simultaneously.

The differential precipitation of the proteins of colostrum and a method for the determination of the proteins in colostrum, P. E. HOWE (*Jour. Biol. Chem., 52 (1922), No. 1, pp. 51-68*).—Data are presented which indicate that when consecutive concentrations of sodium sulphate are added to colostrum or milk the material precipitated by a concentration of sodium sulphate of from 14 to 14.2 per cent may be considered to be euglobulin, that precipitated from 18 to 18.4 per cent a mixture of euglobulin, pseudoglobulin I,

and casein, and from 21 to 22 per cent euglobulin, pseudoglobulin I and II, and casein. The remainder of the nitrogen is considered to be albumin and non-protein nitrogen. Casein is determined by acidification of the filtrate from the 14.2 per cent sodium sulphate precipitation, and nonprotein nitrogen by precipitation with trichloroacetic acid.

A quantitative method for the determination of watered milk and pathological milk, F. KOPATSCHEK (*Milchw. Zentbl.*, 51 (1922), No. 8, pp. 85-87).—The method consists in the determination of the chlorin and lactose content of the milk as follows:

Twenty cc. of milk is pipetted into an 80-cc. graduated flask, and to this is added from a burette 30 cc. of 1.57 per cent uranium acetate. The flask is filled to the mark with distilled water, shaken well, and filtered. The chlorin is determined in 10 cc. of the filtrate by the addition of silver nitrate, with potassium chromate as an indicator. The lactose is determined in another portion polarimetrically. The values obtained can be compared with normal values by the use of the formula, $K=1+44xCl$.

A method for the determination of small amounts of lactic acid, S. W. CLAUSEN (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 263-280, fig. 1).—The Fürth-Charnass method for the estimation of lactic acid (*E. S. R.*, 24, p. 213) has been found to be adapted to quantities of from 0.2 to 10 mg, provided the determination of the aldehyde is made by a modification of the Ripper method (*E. S. R.*, 13, p. 524) in which, after the end point is reached in the titration of excess bisulphite, a small amount of sodium carbonate is added and the bound sulphite titrated.

For the estimation of lactic acid when present in amounts up to 45 mg., the aldehyde is set free by the action of 50 per cent sulphuric acid, the mixture being heated in a fusible alloy bath to 140° C. for 1 hour.

Directions are given for the application of these methods to the determination of lactic acid in biological materials.

Determination of the hydrogen-ion concentration of urine with indicators, A. SILBERSTEIN (*Biochem. Ztschr.*, 128 (1922), No. 4-6, pp. 534-539).—It has been found possible to determine the H-ion concentration of urine by the colorimetric method provided the urine is first decolorized by shaking with animal charcoal and filtering. The method is thought to be applicable to other colored liquids.

A new method of color measurement for oils, L. W. PARSONS and R. E. WILSON (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 269-278, figs. 11).—Some of the disadvantages in the Lovibond method of color measurement are discussed, the fundamental laws of color measurement are presented in detail, and a new method of determining the true color of oils is described.

The method involves the use of the Duboscq colorimeter with a single standard of a kerosene solution of heavy oil. This is diluted to approximately 35 Lovibond color, and standardized exactly by comparison in the colorimeter with a 50-color Lovibond glass. A special feature in the method is the use with dark oils of so-called thin cells, with which it has been found possible to reproduce thicknesses of 0.1 mm. within 1 per cent. The cell is made from two parallel glass plates of optical glass, on the upper surface of one of which are fastened, by means of Canada balsam, two small sections of microscope slides of definite thickness, leaving a space in the middle of the plate to hold the film of oil.

Action of phosgene on ricinolein, A. PRUTTI and A. CURZIO (*Gior. Chim. Indus. ed Appl.*, 3 (1921), No. 6, pp. 242-244; *abs. in Chem. Abs.*, 15 (1921), No. 17, pp. 2991, 2992).—As a means of detecting adulteration of castor oil, the authors suggest the determination of the so-called chlorin index, which is

the percentage of chlorin in the compound formed by the action of phosgene on the oil.

The method consists in passing phosgene through the oil heated to 100° C., removing the excess of phosgene by repeated washing with water, and drying the product in vacuo over sulphuric acid. This is said to consist of almost pure triglycerid of ricinolein chlorocarbonate, $C_{2}H_5(CO_2ClC_7H_{13}CO_2)_3$. Chlorin is determined by heating from 0.2 to 0.5 gm. of the sample with sodium carbonate in a deep platinum crucible. The percentage of chlorin or the chlorin index averages 9 for castor oil, while olive, peanut, almond, and sesame oil give chlorin indexes of from 0.08 to 0.18. Mixtures of these oils with castor oil in varying proportions gave chlorin indexes corresponding closely to the calculated values.

Grain in molasses, C. Sijlmans (*Arch. Suikerindus. Nederland. Indiv.*, 29 (1921), No. 20, pp. 659–662; also *Meded. Proefsta. Java-Suikerindus., Chem. Ser. No. 5* (1921), pp. 4).—The method of determining grain in molasses, as recommended by Kalshoven (*I. S. R.*, 45, p. 719) and modified by Dëdek (*I. S. R.*, 46, p. 312), has been found to be inapplicable to Java molasses, the results in all cases being lower by heating in an autoclave at 100° C. than by dilution. Certain improvements in the technique of determining grain by dilution are outlined, by the use of which it is said to be possible to determine the true grain to 0.2 per cent.

The effect of colloids on the viscosity of Java sugar cane molasses, W. D. Helderma and V. Khainovsky (*Arch. Suikerindus. Nederland. Indiv.*, 29 (1921), No. 37, pp. 1229–1235, pp. 1; also *Meded. Proefsta. Java-Suikerindus., Chem. Ser. No. 8* (1921), pp. 7, fig. 1; *abs. in Chem. Abs.*, 16 (1922), No. 1, p. 170).—To determine the effect of colloids on the viscosity of sugar cane molasses, viscosity measurements with a slightly modified form of the Arndt viscosimeter were made of samples of molasses from the defecation, sulfitation, and carbonation processes before and after treatment with kieselguhr and with Norit. The molasses was diluted with 4 or 5 parts of water before filtration and then boiled back in a vacuum to the original concentration.

The reduction in viscosity in the three samples following treatment with kieselguhr and Norit, respectively, was as follows: In the defecation sirup 35.1 and 43.7 per cent, in the sulfitation sirup 46.6 and 20 per cent, and in the carbonation sirup 43.6 and 43 per cent. There was a decrease in the content of gums, and more after treatment with Norit than with kieselguhr. There was also a reduction of ash, which was practically the same with both Norit and kieselguhr.

The effect of colloids on the viscosity of sugar cane molasses, H. V. Khainovsky (*Arch. Suikerindus., Nederland. Indiv.*, 29 (1921), No. 41, pp. 1344–1347; also *Meded. Proefsta. Java-Suikerindus., Chem. Ser. No. 10* [1921], pp. 4, *abs. in Chem. Abs.*, 16 (1922), No. 8, p. 1333).—Continuing the above investigation, ultramicroscopic examinations were made of the various samples of the same molasses.

Kieselguhr reduced the number of colloidal particles 84.1 and 93 per cent. Norit caused a reduction of 3.7 to 95.1 per cent, but the treated products contained Norit in colloidal dispersion. The original carbonation molasses had only about half as many colloidal particles as the defecation molasses, and its color was only one-fourth that of the defecation molasses. Kieselguhr removed from 8.4 to 56 per cent of the color and Norit from 36 to 82.1 per cent.

Preparation and evaluation of a decolorizing char from bagasse, C. E. Coates (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 4, pp. 295–298).—Experiments on the preparation and standardization of bagasse char are described in considerable detail. As a standard solution to be decolorized a

3 per cent solution of blackstrap, or third molasses, was boiled and filtered with kieselguhr, a fresh solution being made up every two days. The acidity of the solution was kept at 0.007 N, preliminary tests having shown the importance of uniform acidity in comparing the decolorizing power. For comparison with the bagasse char a good grade of commercial decolorizing char of a high efficiency was taken as a standard and its decolorizing power called 100. Instead of comparing the original molasses and its decolorizing products, the filtrates obtained under standard conditions from the standard and experimental char were compared.

The most efficient method of preparation of the char from bagasse was found to be as follows: The bagasse was first heated for 15 or 20 minutes in a large iron sand bath, which was heated red hot by a battery of Meker burners and covered with a similar sand bath, the two being separated by a heavy triangle of iron wire. The resulting char was ground to a powder, heated for 1 hour at 800 to 850° C., boiled for 2 hours with 20 per cent sodium hydroxid solution with the addition of water from time to time to keep the concentration constant, washed, boiled with 1:1 hydrochloric acid, washed, and dried by heat at 200°. The char thus made had a decolorizing power of 260 as compared with 100 for the standard, 110 for Darco, and 102 for Norit. In addition to removing organic coloring matter, the char was found to have a marked power of absorbing iron salts as shown by the fact that yellow commercial hydrochloric acid used in washing the char came through colorless. The char is low in apparent specific gravity and can be revived by boiling first with 5 per cent sodium hydroxid and then with 5 per cent hydrochloric acid, or by retorting. As determined by the Hess-Ives photometer, the char is particularly efficient in removing red color.

Lye hominy: Its discoloration and a new process for its manufacture, E. F. KOHMAN (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 415-418).—The discoloration in canned lye hominy has been found to be the result of alkalinity due to incomplete washing of the hominy after the lysing process. Repeated washing produced no effect on the alkalinity after the first washing. The addition of acid to neutralize the alkalinity was found impractical as it caused the starch to settle out and the grains to become hard and solid. Among the factors found to affect the alkalinity are the length of the lysing period, the size and shape of the grains, and the age of the corn.

The best method of lowering the alkalinity and of preventing the formation of black discoloration has been found to be the use of a scrubbing or abrasion process, applied directly after lysing. This treatment removes the hulls or outer layer of the grains and thus lowers the alkalinity, and has the further advantage of giving a whiter product than can be obtained by any other process than bleaching.

The discoloration of lye hominy, E. F. KOHMAN (*Natl. Cannery Assoc. Research Lab. Circ.* 2-L (1922), pp. 11).—Essentially noted above.

Some research problems of the canning industry, W. D. BIGELOW (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 375-379, figs. 3).—This is a general discussion of the problems of the canning industry which are under investigation at the research laboratory of the National Cannery Association and elsewhere, together with suggestions of other problems that await solution. The general subjects discussed include food poisons, nutritive value of foods, processing studies, preheating and exhaust, discoloration of canned foods, influence of hard water, and tin plate.

Potash from kelp.—VI, The decolorizing action of adsorptive charcoals, H. G. TANNER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 5, pp. 441-443).—This continuation of a series of papers, previously noted (E. S. R., 47,

p. 410), consists of a theoretical discussion of the nature of the decolorizing action of active carbons. The phenomenon is considered to be the same as that exhibited by fabrics in the process of dyeing, i. e., a process of adsorption.

METEOROLOGY.

Weather and harvest cycles, W. H. BEVERIDGE (*Econ. Jour.*, 31 (1921), No. 124, pp. 429-452, fig. 1).—This article gives index numbers of wheat prices in western and central Europe from 1500 to 1869, as well as the preliminary results of a mathematical analysis of these figures with a view to discovering periodicity. The conclusions reached are summarized "in three propositions of a descending order of certainty:

"First, the yield of harvests in western and central Europe from the middle of the sixteenth to the opening of the twentieth century has been subject to a periodic influence or combination of such influences tending to produce bad harvests at intervals of about 15.3 years, the first epoch falling in 1556. This proposition is about as certain as harmonic analysis can make it.

"Second, this period of 15.3 years, though corresponding to certain physical facts, is not a permanent one, but arises from a temporary combination of two or more shorter cycles. This proposition, though not certain, is in both of its branches highly probable.

"Third, the shorter cycles whose combination has given rise to the 15.3-year period from 1556 onwards, and which are themselves more permanent than their combination, are those named above as A = 4.374 years, B = 5.11 years, and (probably) C = 2.74 years and D = 3.71 years. This proposition is a speculation as to whose plausibility and truth different readers will take different views."

Wheat prices and rainfall in western Europe, W. H. BEVERIDGE (*Jour. Roy. Statist. Soc.*, n. ser., 85 (1922), No. 3, pp. 412-459, pls. 2; *abs. in Nature* [London], 109 (1922), No. 2741, pp. 627, 628; *Jour. Min. Agr.* [London], 29 (1922), No. 4, pp. 333-337).—In this paper the author gives a full harmonic analysis of the figures upon which the above article is based, with a view to the discovery of practically all possible periods between 2 and 84 years' length:

"The amplitudes for more than 300 trial periods altogether have been calculated for a sequence of about 300 years from 1545 onwards, while for a number of these trial periods amplitudes have been calculated separately for the first 150 years and for the second 150 as well. . . . The results of this analysis are summarized in a table showing some 20 apparent periods, ranging in length from 2.2 to 68 years. These are arranged in four groups:

"(1) Periods the reality and persistence of which is beyond doubt, strong evidence from the analysis of wheat prices being confirmed by close agreement of first-rate meteorological evidence. This group includes the period of 2.2 years discovered originally by C. E. P. Brooks, and later by J. Baxendell, in rainfall; the period of 5.1 years discovered by J. Baxendell in wind and rainfall and by D. Brunt in Greenwich temperature; and the period of about 35 years discovered in 1800 by Brückner in temperature, rainfall, and barometric pressure.

"(2) Periods strongly indicated by the wheat prices but for which meteorological confirmation is, at present, weaker or lacking. This group includes seven periods of 5.671, 9.75, 12.84, 15.225, 19.9, 54, and 68 years. Most of these periods are relatively long, a fact which helps in explaining failure to demonstrate them hitherto in meteorological records. For most of them some meteorological parallel can in fact be found.

"(3) Periods for which there is good, but not first-rate, evidence both in wheat prices and in meteorology. There are four of these with lengths of 3.415 years, 4.415 years (traced by Baxendell in rainfall), 5.9 years (traced

by various writers in barometric pressure), and 8.05 years (no doubt the same as the period to which H. L. Moore and others have directed attention).

"(4) The fourth group includes periods, some of which no doubt have reality, but all of which present inconstancy of action, changes of phase, or other puzzling features. These include periods of 2.735, 5.423, 7.417, 12.05, and 17.4 years in addition to the well-known 11-year period of the sunspots, which reappears in wheat prices with much of its normal instability of character. . . .

"Comparison between the weather cycles indicated by analysis of wheat prices from 1550 to 1850 and the actual rainfall in the ensuing 72 years, 1850 to 1921, confirms the view that these periodicities are real and important. For the purpose of this comparison, 11 of the 13 cycles in the first three groups are combined by a simple graphic method, the lengths and phases taken being exactly those determined by harmonic analysis. The combined result is shown in a single 'synthetic curve,' and is compared with the rainfall at 24 stations in western and central Europe (i. e., roughly the same area as that covered by the wheat prices' records). A very high measure of agreement appears between the synthetic curve derived from wheat prices before 1850 and the rainfall as actually recorded after 1850.

"In particular, the synthetic curve shows depressions foretelling lack of rain (which, in the area under review, is generally beneficial to wheat) at each of the markedly dry years in the past 70, namely, 1857, 1864, 1870, 1874, 1883-84, 1887, 1898, 1904, 1908-9, 1921. It shows peaks foretelling heavy rain in the rainy years 1852, 1866, 1872, 1876 (for 1877), 1906, 1912, 1916. The only important discrepancies are the failure of the synthetic curve to show peaks for the rainy years, 1860 and 1903, and a depression for the somewhat local, though severe, drought of 1893. In other words, the synthetic curve which, subject to certain reservations, could have been drawn in 1850, if then drawn, would have foretold nearly all the important droughts and rainy seasons of the next 70 years. The drought of 1921 stands out quite remarkably well."

The author expresses the belief that "in view of the persistence which it now seems right to attribute to certain periodicities in the weather, trustworthy prophecy of the weather will, in due course, become possible. . . . It will become possible, if at all, only after detailed investigation has shown the nature, the shape, the relative importance, and, above all, the local variations of each of the cycles, of which we can now say little more than that they exist and cause periodic changes in the rainfall, or, to put it in another way, only after we have managed, from the cycles found, to reconstruct not the main features only, but all the significant features of the weather in some past sequence of years. That, I hope, can be done as soon as properly equipped inquirers are prepared to devote sufficient thought and time to the purpose. . . .

"The causes and physical nature of the cycles shown in wheat prices must be sought in other fields, above all in the comparative study of meteorological records for all parts of the world."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 9 (1922), Nos. 5, pp. [190], pls. 3, figs. 2; 6, pp. [189], pls. 4, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1922, respectively.

Rainfall and temperature in New South Wales, H. A. HUNT (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 6, pp. 414, 415-417).—Tables are given which show the altitude, monthly and annual rainfall, extremes of temperature, and frost-free period for over 90 stations for periods of not less than 19 years.

SOILS—FERTILIZERS.

Soils and fertilizers, E. J. RUSSELL (*Soc. Chem. Indus. [London], Ann. Rpts. Prog. Appl. Chem., 1921, vol. 6, pp. 403-417*)—This report summarizes the progress in those aspects of agricultural chemistry relating to soils and fertilizers during the year 1920 with particular reference to European conditions.

De Kalb County soils, J. G. MOSIER ET AL. (*Illinois Sta. Soil Rpt. 23 (1922), pp. 54, pls. 2, figs. 7*)—This survey deals with the soils of an area of 401,928 acres lying in the Wisconsin and Iowan glaciations in northern Illinois. The topography varies from flat to slightly rolling. The southeastern part of the county is said to require tile drainage, while the underdrainage conditions along the stream courses are said to be favorable.

The soils of the county are grouped as upland prairie, upland timber, terrace, and swamp and bottomland soils. Seventeen soil types are recognized, of which the brown silt loam upland prairie soil covers 81.68 per cent of the area.

Studies of the fertility requirements and crop adaptations of the prevailing soil types are also included, which indicate in general a tendency on the part of the majority of the soils to eventually become deficient in nitrogen and phosphoric acid.

Soil survey of Wright County, Iowa, T. H. BENTON and C. O. JAECKE (*U. S. Dept. Agr., Agr. Sheets Field Oper. Bur. Soils, 1919, no. 42, fig. 1, map 1*)—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 368,000 acres lying within the Wisconsin glaciation about midway between the center of the State of Iowa and its northern boundary. The land surface is that of a broad level drift plain broken in the eastern half by scattered hills. The drainage is said to vary from sluggish to poor over most of the county.

The soils are mostly of glacial origin. Including gravel pits, peat, and muck, 17 soil types of 9 series are recognized, of which the Webster silty clay loam, Webster loam, Carrington loam, and Clarion loam cover 29.5, 25.1, 22.1, and 13.9 per cent of the area, respectively.

[**Soil studies at the Iowa Station**] (*Iowa Sta. Rpt., 1921, pp. 16-20*)—The results of a number of general field and greenhouse experiments to determine soil fertility requirements and the relative value of different fertilizers are briefly discussed, and general data are presented on acid soils and the use of lime, the value of commercial cultures for legumes, and the value of gypsum applied to Iowa soils.

The studies of fertility requirements of Iowa soils indicate the value of limestone for acid soils and the rather general importance of using manure and some form of phosphoric acid on practically all of the soils.

Soils, A. F. JOSEPH (*Wellcome Trop. Research Labs., Chem. Sect. Pub. 22 (1922), pp. 18-28*).—A general summary of work on the soils of the Sudan, particularly as conducted at the Gezira Research Farm, is presented in this report. Mechanical analyses of 185 samples of soils from seven different provinces in Sudan, in addition to 220 samples from the research farm, are summarized.

Studies of the clay content of the soils of the farm showed that this content reaches a maximum between the fourth and sixth foot. An increase in the salt content from the first to the fourth foot is also clearly indicated.

The relation of the salt content of the soil to crop yields was studied, and in every case there was a higher concentration of water-soluble salts in the poor than in the good soils.

The coarse sand and the stones and gravel fractions of the soils of the research farm were found to consist mainly of calcium carbonate with about 10

per cent of silica. The silt and clay are thought to consist mainly of alumina and iron silicates. The alkalis in the soil are mainly associated with the clay fraction.

A number of experiments on flocculation, carried out with carefully dialyzed clay fractions from the soils of the farm, showed that with different acids the necessary concentration of flocculant depends on factors other than the dissociation constant of the acid. Salts differed as much as acids in flocculating power. The flocculation by salts was prevented by alkalis within the limits of certain concentrations.

Studies on the behavior of clay toward acids showed that in no case was the whole of the clay used successfully dissolved in hydrochloric acid. As regards the absorptive power of clays, most of the clay suspensions examined by adding an amount of methylene blue equal to the weight of clay absorbed between 30 and 40 per cent of the dye. A specially purified suspension of clay from the farm gave an absorption of 70 per cent. Red clay was found to be very weak in this respect, absorbing only about 2 per cent of its weight.

The H-ion concentration of cotton soils was found to indicate alkalinity for all soils so far examined, the pH value being over 8.

Studies of the mineral and organic carbon content of soils of the research farm showed a maximum percentage of carbonate in 12 samples from three 4-ft. holes of 9.4, a minimum of 3.9, and an average of 6.3. The mean percentage in the upper 2 ft. was 7 and in the lower 2 ft. 5.7. The percentage of organic carbon in the same samples varied between 0.093 and 0.385, with a mean value of 0.234.

The formation of soil crumb structure and tilth. P. EHRENBERG (*London. Vers. Sta.*, 99 (1922), No. 2-3, pp. 115-121).—It is noted that unfavorable conditions of the soil structure are frequently attributed to OH ions, and that in contrast thereto the positively charged calcium ions may have an especially favorable action in the production of crumb structure. In recent studies the author found that OH ions were strongly adsorbed by soil and thereby electrically charged. In combination with the weakly precipitating alkali ions, such as potassium, sodium, and ammonium, the soil structure was injured. The presence of OH ions in great quantity increased flocculation and crumb structure formation when more strongly precipitating ions such as calcium were present in sufficient quantities. It is concluded that through this process OH ions may have a highly favorable influence upon soil structure.

The unfavorable influence of heavy fertilization with caustic lime frequently observed on heavy soils deficient in lime is explained on the ground that all the carbon dioxide present is fixed as calcium carbonate, and very little or no formation or fixation of carbon dioxide can take place, since bacterial life is strongly depressed by the caustic lime. Therefore of the calcium salts present, only the hydroxids are in solution. These are adsorbed by the heavy clay, leaving only a very low calcium hydroxid concentration in the soil solution and resulting in injury to the soil structure.

The unfavorable action of sodium chlorid from sea water on soil structure is attributed to the displacement of calcium ions by sodium ions.

Investigations on soil acidity and its action on germinating plants. O. LEMMERMANN and L. FRESSENIUS (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 1, Wiss., pp. 12-32, figs. 7).—A review and comparison of methods for determining soil acidity is followed by the results of a study to determine the influence of different types and degrees of soil acidity on the germination of rye, wheat, oats, and barley.

It was found in sand cultures that the smallest concentration of sulphuric acid used seriously interfered with the germination of wheat. Rye and barley

were able to resist about four times as much sulphuric acid as wheat, and oats proved to be the most resistant of the plants tested. The addition of a neutral salt seemed to increase the injury to rye and oats. The same result was obtained where acetic acid and sodium acetate were used.

Studies with a neutral weak humus sand soil similarly treated with mineral and organic acids and neutral salts showed the same relative degrees of sensitiveness to acidity by the four crops. A comparison of these results with those obtained with four other neutral soils led to the conclusion that when a sand soil is shaken with neutral potassium chlorid and gives a hydrogen exponent as low as 4.5, the degree of acidity is in general sufficient to injure plant growth.

Influences on the formation of soil acids, J. KÖNIG, J. HASENBÄUMER, and E. KRÖGER (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 1, Wiss., pp. 3-12).—Studies to determine the influence of different fertilizer materials alone on the acidity of uncropped soil were conducted on loamy sand soil. The acidity of unfertilized soil was increased by periodic watering. Superphosphate, potash, and ammonia fertilizers when added alone in normal amounts also increased the acidity. Sodium nitrate, lime nitrogen, and Thomas meal had a less marked influence and in some cases decreased the acidity. Lime marl reduced the acidity in accordance with the amount used.

Laboratory studies of the variation of the H-ion concentration of a soil growing a single crop of oats, but with varying fertilization, were conducted with the same soil. The growth of oats had practically no effect on soil acidity. Where Thomas meal was used the acidity was somewhat less than where ammonia and potash salts were added. The use of lime marl brought the reaction almost to neutral. Field studies with oats gave similar results.

Pot studies with oats, corn, grass, peas, clover, lupines, buckwheat, and mustard on the same soil to determine the influence of the growth of different plants on soil acids were also conducted. Corn, lupines, and buckwheat were found to liberate acids, while the other plants did not. The legumes gave off more acid through their roots to the soil than the gramineous plants. It is concluded that the grasses had little influence on soil acidity, while the peas, lupines, and buckwheat caused a marked increase in acidity. Clover and mustard acted similarly to the grasses.

The influence of moisture and soluble salts on the bacterial activities of the soil, J. E. GREAVES and E. G. CARTER (*Soil Sci.*, 13 (1922), No. 4, pp. 251-270, figs. 16).—Continuing work previously noted (E. S. R., 44, p. 315), studies conducted at the Utah Experiment Station on the influence of various soluble salts on the water requirements of the ammonifying and nitrifying organisms of a sedimentary sandy loam soil very high in acid-soluble constituents and highly calcareous, are reported. The influence of the chlorids, nitrates, sulphates, and carbonates of sodium, potassium, magnesium, and calcium were studied. The water-holding capacity of the soil was 45 per cent.

Untreated soil, that receiving sodium carbonate, potassium carbonate, potassium nitrate, calcium carbonate, calcium sulphate, calcium nitrate, magnesium chlorid, and magnesium carbonate, had maximum ammonifying powers when the soil contained 30 per cent of water. Soils containing sodium sulphate, sodium nitrate, potassium chlorid, and potassium sulphate possessed maximum ammonifying power at a water content of 35 per cent, whereas when magnesium sulphate or magnesium nitrate were added to the same soil maximum ammonification occurred at a content of 25 per cent of water.

The relative toxicity of sodium chlorid, sodium carbonate, potassium carbonate, and calcium carbonate, as measured in terms of ammonification, decreased as the amount of water added increased. All the other salts tested

became relatively more toxic, thus indicating that in the case of these latter some other factor than osmotic pressure played a part.

Untreated soil, soil containing sodium carbonate, sodium sulphate, sodium nitrate, potassium chlorid, potassium carbonate, potassium sulphate, potassium nitrate, magnesium chlorid, and magnesium carbonate, exerted their maximum nitrifying powers when the soil contained 20 per cent of water; whereas soil containing potassium carbonate, calcium sulphate, calcium nitrate, calcium carbonate, magnesium nitrate, and magnesium sulphate were at maximum nitrifying power when the soil contained 25 per cent of water. Soils containing sodium chlorid and calcium chlorid were at a maximum with 30 per cent of water.

The relative toxicity of various salts to the nitrifying organisms decreased as the amount of water added was increased. The mere changing of the water content of a soil containing small quantities of potassium chlorid, potassium sulphate, magnesium nitrate, and magnesium chlorid may transform it from a toxic medium for nitrifiers to a strongly stimulating medium.

"When 1×10^{-3} mol of sodium nitrate was added to 100 gm. of soil containing 35 per cent of water there was a loss of nitrates, but a similar quantity of calcium nitrate or even larger quantities of magnesium or potassium nitrate caused no loss of nitrates even in the presence of 35 per cent of water."

Effect of cultivation during the growing season on moisture content and formation of nitrates in the soil (*Arkansas Sta. Bul.* 181 (1922), pp. 41, 42).—Moisture and nitrate determinations made by W. H. Sachs and R. H. Austin in connection with the regular cultivation experiments with corn, to determine the influence of different methods of cultivation on moisture retention in the soil and the availability of nitrogen, are said to indicate the heavy drain of weeds on the supply of both moisture and nitrates. The highest seasonal average of nitrates in the soil accompanied deep cultivation.

The rôle of the carbonic acid freed by microorganisms in the amelioration of arable soils for obtaining the best cultural returns, STOCKLASEA (*Compt. Rend. Acad. Agr. France*, 8 (1922), No. 21, pp. 594-596).—The author found in laboratory studies that in the top 36 cm. (14.17 in.) of soils of average fertility, 1 kg. of soil (2.2 lbs.) at the same temperature and degree of humidity will set free 30 mg. of carbonic acid in 24 hours, which will amount to 15,000,000 liters of carbonic acid per hectare (1,609,230 gal. per acre) per year. The activity of this material in direct and indirect plant nutrition is discussed.

The carbon dioxid question, DENSCH (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 1, *Wiss.*, pp. 32-39).—The author summarizes the results of studies by himself and others bearing on the use of excess carbon dioxid in promoting plant growth, and draws the conclusion that the assimilation of carbon dioxid by plants is governed more by the factors light, heat, and moisture than by the quantity of carbon dioxid in the atmosphere or soil.

The distribution of soil protozoa in the Alps, W. K. H. FEUILLETAU DE BRUYN (*Centbl. Bakt. [etc.]*, 2. Abt., 56 (1922), No. 1-4, pp. 12, 13).—Studies of the protozoan content of 26 different soils from the Alps are reported.

Protozoa were found to be more or less widely spread throughout these soils. The ciliates were the most numerous, and the flagellates were second in number. Amoebae were found only in exceptional cases. It was found that protozoa were present in a moist soil and absent in a dry soil of the same type. It is thought that the dryness of the weather may have influenced the results of the study.

Humus investigations (*Iowa Sta. Rpt.* 1921, p. 59).—In a continuation of studies on the formation and composition of humus (*E. S. R.*, 46, p. 317),

it was found that no correlation exists between the lime requirements and H-ion concentration of 50 soils of different types. A sandy loam with a low lime requirement may have a much higher H-ion concentration than a silt loam with a much greater lime requirement. Also an acid soil deficient in organic matter was found to have a higher H-ion concentration than one of the same lime requirement having a high organic matter content.

Studies on the effects of H-ions on molds have shown that when inoculated into acid solutions these molds cause a change toward alkalinity, while if inoculated into alkaline media they shift the reaction in the opposite direction. It has also been found that the optimum range of H-ion concentration for their growth is wide, but that near the critical concentrations slight changes in the reaction affect the molds very greatly.

Organic matter for the soil (*Rhode Island Sta. Rpt. 1921*, pp. 2, 3).—The progress results of studies on the use of green manures, stable manure, and peat as organic matter for the soil are briefly presented (E. S. R., 46, p. 213). With a fertilizer containing only a little nitrogen about a fourth more of corn was produced where red clover was used as a green manure than where vetch, sweet clover, or alfalfa was used.

In the market-garden rotations when supplied with plenty of fertilizer, early cabbage following late celery of the preceding year gave about the same yields, regardless of whether organic matter was supplied to the rotation in stable manure, peat, or green manures. The crops of early tomatoes and late celery, however, did not yield as well with the peat and green manures as with stable manure. Early lettuce and late beets and spinach never succeeded on the peat plot, even when accompanied with more lime and fertilizer than was used with the stable manure. About a tenth less of potatoes was grown where only fertilizer chemicals were used than where 10 cords of manure per year were used.

[Rotation and fertilizer work and cooperative fertilizer experiments at the Arkansas Station] (*Arkansas Sta. Bul. 181* (1922), pp. 17-19, fig. 1).—The first season's results from general rotation and fertilizer studies at the Fayetteville farm of the station, conducted by M. Nelson, W. H. Sachs, and R. H. Austin, are briefly presented, together with the progress results of cooperative fertilizer experiments which have been carried on at different points in the State for several years. The cooperative experiments are said to have shown that throughout the upland section of the State there is a widespread need for additional nitrogen and phosphorus in the soil. Even the lowland soils which have been under cultivation for years are said to respond to the use of either one or both of these elements.

The results indicate further that in the fertilization of cotton on the sandier uplands a complete fertilizer will usually give the best returns, while on the delta lands acid phosphate alone or acid phosphate and some readily available form of nitrogen are usually the most profitable. Medium applications of fertilizer generally proved more profitable than the more heavy applications.

Efficiency of fertilizers and other manures (*Rhode Island Sta. Rpt. 1921*, pp. 3-5).—The progress results of general fertilizer studies to determine the best sources of the important fertility constituents for different crops on the soils at the station are briefly summarized (E. S. R., 46, p. 217).

Some results from fertilizers on muck soils, M. M. McCool, and P. M. HARMER (*Jour. Amer. Peat Soc.*, 15 (1922), No. 3, pp. 8-14, figs. 4).—Experiments conducted by the Michigan Experiment Station to determine the influence of fertilization on muck soils growing pasture, sweet clover, sunflowers, corn, and sugar beets are briefly reported.

The most striking deficiency of these soils appeared to be potash, and phosphoric acid was also needed to a considerable extent, particularly by sugar beets. It was found that the tonnage of sugar beets produced on this soil is very low unless it is fertilized. The sugar content of the beets was appreciably increased by the addition of potash, and a combination of potash and phosphoric acid increased it still further. The addition of nitrogen caused some increase in the tonnage but did not affect the sugar content, while both the yield and sugar content were increased by the use of manure. The best results were obtained with corn where both potash and phosphoric acid were added to the muck soil.

Nitrogen fertilization with the liquid manure drill, E. BLANCK, W. GEILMANN, F. GISECKE, and F. ALTEN (*Jour. Landw.*, 69 (1921), No. 4, pp. 215-235, fig. 1; *abs. in Zentbl. Agr. Chem.*, 51 (1922), No. 5, pp. 129, 130).—Experiments on deep loam soil to determine the fertilizing value of liquid manure applied as a top-dressing, as a top-dressing and then dug under, and to a depth of 5 cm. (1.97 in.) by means of a so-called liquid manure drill are reported. The crop used was sugar beets. Sodium nitrate in solid form and in solution applied by the drill was used for comparison.

The liquid manure applied by the drill gave much better results than a liquid manure top-dressing or liquid manure dug under, and as good results as a top-dressing of sodium nitrate. It is noted that a high temperature prevailed when the liquid manure was applied by drill.

Fertilizer experiments with increasing nitrogen additions, KÜHNERT (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 3, *Wirtschaft.-Prakt.*, pp. 122-124).—Experiments on heather sand moor soil to determine the influence of increasing additions of sodium nitrate on the yields of rye and potatoes are reported. Sodium nitrate was applied to rye at rates of 300, 400, and 500 kg. per hectare (267, 356, and 445 lbs. per acre). The application of 400 kg. gave the best results. The applications to potatoes were 400, 600, and 800 kg per hectare. The potato crops on plots fertilized with sodium nitrate endured the extremely dry weather much better than those on unfertilized soil and throughout the growing period had a heavier foliage. The potato crops apparently increased with increasing additions of sodium nitrate.

Synthesis of urea from ammonia and carbon dioxide, N. W. KRASE and V. L. GADDY (*Jour. Indust. and Engin. Chem.*, 14 (1922), No. 7, pp. 611-616, figs. 9).—In a contribution from the Fixed Nitrogen Research Laboratory, U. S. D. A., the development of a process for the synthesis of urea from ammonia and carbon dioxide is described. The process consists in the preparation of ammonium carbamate, autoclaving to cause partial conversion to urea, distillation of the resulting sludge to separate the urea from the unconverted ammonia and carbon dioxide, and condensation of the distillate with additional gas to form a new charge. The studies were conducted with a small-scale experimental plant.

Cost considerations led to the conclusion that the cost of urea by this process will be largely dependent upon the cost of ammonia. It is considered possible that the process may have commercial significance for the production of urea for fertilizer purposes.

Manufacture of phosphoric acid in the electric furnace by the condensation and electric-precipitation method, T. SWANN (*Jour. Indust. and Engin. Chem.*, 14 (1922), No. 7, pp. 630, 631).—The electric-precipitation method of the manufacture of soluble phosphoric acid is briefly described, with particular reference to the use of this material as a fertilizer.

The process consists in charging a mixture of phosphate rock, coke, sand, and iron borings into an electric furnace and smelting the charge so as to

liberate the phosphorus in the phosphate rock. The iron absorbs a certain portion of the phosphorus and forms ferrophosphorus, containing from 24 to 25 per cent of phosphorus. The phosphorus not absorbed by the iron passes through the charge together with the other furnace gases, which are oxidized by air and drawn out of the furnace into the condensing and precipitating apparatus. The acid as collected analyzes from 90 to 95 per cent phosphoric acid. One of the outstanding features of the process is said to be the production of high-grade concentrated acid from phosphate rock containing a high percentage of iron. It is stated that the commercial production of phosphoric acid by this process is now being successfully conducted.

Progress in phosphoric acid production for fertilizer and food purposes, W. H. WAGGAMAN (*Chem. Age [New York]*, 30 (1922), No. 7, pp. 302-305).—Progress in the production of phosphoric acid by means of the furnace method is briefly reviewed, and some of the more recent results obtained by the U. S. Department of Agriculture at its experimental plant at Arlington, Va., are discussed.

It has been found that the necessary temperatures can be attained by means of fuel oil, and, while no conclusions are drawn, it is stated tentatively that unless electric energy is available at a price much lower than prevailing prices the cost of a unit of phosphoric acid made by the fuel-fed furnace process should be materially lower than that obtained by the electric furnace method. It is concluded that as far as production of very pure phosphoric acid is concerned the furnace process is superior to the sulphuric acid method. However, in the manufacture of phosphates for agricultural purposes, the furnace process is not sufficiently advanced to be a factor.

The availability of rock phosphate in acid soil (*Arkansas Sta. Bul.* 181 (1922), pp. 15, 16).—Greenhouse and laboratory experiments by M. Nelson and W. H. Sachs on the availability of rock phosphate in acid soils have shown that corn can use phosphorus when added to an acid soil in the form of finely ground rock phosphate. There was an increase in the percentage of phosphorus in the corn plant as well as in the total amount of phosphorus in the crop. Where an acid soil was treated with a finely ground rock phosphate, the addition of lime appeared to decrease the amount of phosphorus available for the corn plant.

The fertilizing action of phosphoric acid on Brunswick (Germany) soils, A. GEHRING (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 3, *Wirtschaft.-Prakt.*, pp. 125-131).—The results of 14 experiments with different grain and root crops are reported, showing that in spite of continuous previous fertilization with phosphoric acid there was a distinct reaction to phosphate fertilization in most cases. This is taken to indicate that there is not usually an excessive accumulation of phosphoric acid in cropped Brunswick soils.

Phosphate and limestone for Kentucky soils, S. C. JONES and R. E. STEPHENSON (*Ky. Agr. Col. Ext. Circ.* 123 (1922), pp. 19, figs. 2).—Data on the increases in crops produced by phosphates and limestone applications on seven different experimental fields in Kentucky are reported and discussed in this circular. In most cases a 4-year rotation of corn, soy beans, wheat, and clover was used with a rye cover crop between the corn and soy beans. The data indicate that acid phosphate alone gave satisfactory results on all the experimental fields except two, and in these two cases acid phosphate was highly profitable when used with limestone.

Most soils that gave satisfactory results with acid phosphate also gave satisfactory results with rock phosphate where no limestone was used. In most cases rock phosphate was more profitable than acid phosphate on unfertilized soil. Satisfactory results were obtained on only three fields where limestone

was used with rock phosphate, however. On the other fields the use of limestone with rock phosphate rendered the rock phosphate less satisfactory with each succeeding application of limestone.

It was also found that no soil can be built up to a high state of productivity by use of limestone and phosphate alone, but that nitrogen and organic matter must be supplied.

The action of different potash salts (40 per cent potash salt, kainit, potassium magnesium sulphate) on grain and root crops, B. TACKE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 3, *Wirtschaft.-Prakt.*, pp. 97-111) Ten years of experiments on upland moor soil to determine the relative fertilizing values of 40 per cent potash salt, kainit, and potassium magnesium sulphate on grain and root crops, including oats, rye, and potatoes, are reported.

The potassium magnesium sulphate gave better results on potatoes than the other potash fertilizers with reference to both total yield and starch content. On the other hand, the results obtained with grain crops through a period were on the average poorer than those given by 40 or 50 per cent potash salt or kainit. No influence of amount of lime treatment on the potash content of crops in accordance with the Ehrenberg lime-potash law was established.

Elimination of borates from American potash, W. H. ROSS and W. HAZEN (*Chem. and Metall. Engin.*, 27 (1922), No. 4, pp. 167-170, figs. 3).—In a contribution from the U. S. D. A. Bureau of Soils, the steps taken by producers to eliminate borates from domestic potash fertilizers are briefly described.

Analyses of commercial fertilizers, H. E. CURTIS, H. R. ALLEN, and R. H. RUGGELL (*Kentucky Sta. Bul.* 238 (1921), pp. 365-505) -- The results of analyses with the guarantees and relative valuations of 1,530 samples of 889 brands of fertilizers and fertilizer materials collected for inspection in Kentucky during 1921 are presented in this bulletin.

1922 yearbook commercial fertilizer (*Yearbook Com. Fert.*, 1922, pp. 166, figs. 33) - This number of this yearbook contains the usual classified directories of fertilizer manufacturers and allied trades and of cottonseed oil mills, and includes a number of special articles relating to the fertilizer industry and the use of fertilizers in agriculture.

AGRICULTURAL BOTANY.

Photosynthetic processes in the air, upon the land, and in the sea in relation to the origin and continuance of life on the earth, B. MOORE (*Jour. Chem. Soc. [London]*, 119 (1921), No. 708, pp. 1555-1572, pl. 1, figs. 3) —In this, the Hugo Müller lecture delivered before the Chemical Society of London on June 16, 1921, the author attempts to summarize the outcome of work, mainly botanical, done during 10 years, naming, as among his collaborators in parts thereof, E. Whitley and A. Webster. Though presented from a philosophical point of view rather than from that of the botanist, chemist, or economist, the discussion marshals considerable scientific data not previously published. Other portions have been recorded in the proceedings of the society during the previous 10 years.

Photocatalysis.—I, The synthesis of formaldehyde and carbohydrates from carbon dioxide and water, F. C. C. BALY, I. M. HEILBRON, and W. F. BARKER (*Jour. Chem. Soc. [London]*, 119 (1921), No. 705, pp. 1025-1035).—Discussing evidences and conclusions presented in the series of contributions by Moore and Webster (E. S. R., 40, p. 426), and noting particularly the inference that the photosynthesis of biochemical substances from formaldehyde

does not take place in the plant, the present authors claim on the basis of their own experimentation that it is possible to synthesize carbohydrates from carbon dioxide and water in light and that formaldehyde does form the first stage in the photosynthetic process. A critical examination is made of the facts and conditions determining results and conclusions offered. It is claimed that an aqueous solution of carbon dioxide gives formaldehyde when exposed to wave lengths of 200μ , while an aqueous solution of formaldehyde is polymerized to reducing sugars in wave length 290μ .

In the presence of paraldehyde, sodium phenoxide, and certain metallic salts which absorb wave lengths of 290μ , the yield of formaldehyde is materially increased. These substances do not catalyze the reaction but protect the formaldehyde, when formed, from polymerization. Further chemical data are given in some detail.

Seasonal changes and translocation of carbohydrate materials in fruit spurs and 2-year-old seedlings of apple, S. K. MITRA (*Ohio Jour. Sci.*, 21 (1921), No. 3, pp. 89-103, figs. 7).—This is a part of the larger problem of determining what effect the carbohydrate content of fruit spurs has upon vegetative growth and reproduction, and to what extent it should be considered in handling fruit trees. The methods, work, and data, as noted in condensed form, show that as regards apple fruit spurs change of temperature has a marked bearing on the translocation of carbohydrate materials. Further conclusions are given in considerable detail.

The relation of the hydrogen-ion concentration of nutrient solutions to growth and chlorosis of wheat plants, A. G. McCALL and J. R. HAAG (*Soil Sci.*, 12 (1921), No. 1, pp. 69-77, figs. 2).—The fact, indicated as the conclusion from work previously noted (*E. S. R.*, 44, p. 621), that none of the differences in the growth rate of wheat plants in sand cultures with any one type of solution could be attributed to variations in the H-ion concentration of the nutrient solutions, does not preclude the possibility that the relative merit of the six types of solutions is influenced to some extent by their respective ranges. The H-ion concentration ranges previously found, as summarized with discussion, and other considerations indicated, suggested the work which is briefly described in the present paper.

Wheat plants were grown for two months in four different basic nutrient solutions, each of which was modified in such a way as to have three distinctly different pH values without materially altering the solutions with respect to the concentration of the six essential ions. The H-ion concentration not only exerted a very marked influence upon the growth rate, but also was an important factor in the control of chlorosis. Although the exact rôle of the H-ion concentration is not understood, the appearance of the chlorotic plants and some indirect evidence would indicate that the plants grown in solutions having pH values ranging from 4.02 to 7 were suffering from the lack of available iron or from faulty metabolism resulting from the immobility of the iron within the plants.

The data presented emphasize the importance of the proper control of the H-ion concentration with all work of this kind.

Studies on the root nodule organism of the leguminous plants, N. V. JOSHI (*India Dept. Agr. Mem., Bact. Ser.*, 1 (1920), No. 9, pp. 247-276, pls. 9, fig. 1).—The results of cross-inoculation experiments here reported tend to indicate that there is only one species of the legume nodule organism if nitrogen assimilation and stimulation thereby be taken as the characteristic function of the organism. If, however, nodule formation be taken as the characteristic activity, this conclusion requires modification.

In the absence of nodule formation after inoculation, some benefit was derived through nitrogen fixation. Advantage is supposed to be derived from nodule-bearing plants through assimilation of metabolic products of organisms growing in the nodules. The root nodule organism is said to exert a beneficial influence also on graminaceous plants. Benefit is derived also by plants separated by porous walls from the growing organism. The chief function of the root nodule organism appears to be nitrogen fixation whether within or outside the nodules. Inoculation of *Azotobacter* gives results similar to those obtained in case of the nodule organism when it does not form nodules. The fact that there is no residual nitrogen in the case of the nodule organism as contrasted with *Azotobacter* suggests that the fixation of the nitrogen by the organism and assimilation of the same by the plant with and without nodule formation go on approximately at the same rate. This implies the necessity of the removal of the products of metabolism by the plant before further nitrogen fixation by the organism can take place. Further experimentation is needed.

The root nodule organism can be isolated on some media direct from the soil. Soil-extract-mannite-agar has proved so far the best. A modification of the medium so as to make it more suitable for the growth of the root nodule organism is suggested.

Effect of salt solutions having definite osmotic concentration values upon absorption by seeds, W. RUBOLFS (*Soil Sci.*, 11 (1921), No. 4, pp. 277-293, figs. 2).—The purpose of this paper is to report a part of the data obtained from a series of experiments which were designed to determine to what extent salt solutions with definite osmotic concentration values tend to resist water absorption by seeds placed in contact with them, and whether this influence has a direct bearing upon germination. The data deal only with that portion of the work which has to do with the rates of imbibition as these are influenced by the osmotic concentrations of the different solutions employed.

It was found that marked differences exist in the absorbing powers of seeds of different species, those of the leguminous type showing higher absorption rates than do those of other types. The highest rates are indicated for alfalfa, the lowest for corn. Absorption rates are progressively retarded with an increase in the osmotic concentration values of the solutions which do not react with the seed substance to modify in a chemical way the imbibing properties of the seeds.

Apparently retardation of the absorption rates is accomplished through osmotic resistance offered to water entrance into the seed.

Low osmotic concentrations appear to have a stimulating influence upon the absorption rates of the seeds of some species. The physiological significance of this fact remains undetermined.

Increasing the length of the time period during which the seeds are in contact with the solutions has the effect of increasing the differences between the quantities absorbed from solutions of low and from those of high osmotic concentration values.

Respiration of dormant seeds, H. SHERMAN (*Bot. Gaz.*, 72 (1921), No. 1, pp. 1-30, figs. 4).—The respiratory intensity (expressed in milligrams of CO₂ eliminated per gram of imbibed seeds per hour) was determined experimentally for *Amaranthus retroflexus*, *Chenopodium album*, and *Rumex crispus*, as well as for *Crataegus* sp. and certain drupaceous Rosaceae. Determinations of the catalase activity were also made for most of the seeds, and it was found that catalase activity increases in *Crataegus* under after-ripening and germinating conditions (10° C.) up to the forty-second day. Respiration reaches a maximum intensity earlier (sixth to eighth day), and thereafter

exhibits a slow and fluctuating decline, at least as far as to the seventy-seventh day.

In *Amaranthus* both catalase activity and respiration are relatively stable. Fluctuations in catalase activity and in respiratory intensity do not occur simultaneously and may be in opposite directions. The respiratory quotient and respiratory intensity vary markedly for different seeds, and in the *Rosaceae* for different lots of the same kind of seed under precisely similar experimental conditions. Stability or variability of the quotient may be of significance as indicative of the possibility of an interplay of several factors on the metabolism. A study of the respiratory quotients for each seed seems to indicate a tendency toward a typical respiration.

Effect of location of seed upon germination, E. N. MUNNS (*Bot. Gaz.*, 72 (1921), No. 4, pp. 256-260).—The marked influence of parent trees upon the size and germination of seeds of *Pinus jeffreyi*, as shown in a paper previously noted (E. S. R., 42, p. 241), led to the present study, which was intended to determine the value of seeds from the different parts of the pine cone and to decide what relation, if any, exists between the position of the seed and germination. The relative advantages or disadvantages of large, medium, and small cones are indicated.

Size, which is proportional to weight rather than position, is the determining factor as regards germination percentage. To secure the best possible forest, it is believed that forest nursery practice should be confined to the production of trees from the heaviest, and therefore the largest, seed.

Reduced acidity in oranges caused by certain sprays, G. P. GRAY and H. J. RYAN (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 1, pp. 11-33).—After confirming the view that orange fruit flavor is affected by certain sprays, the authors made extensive and varied systematic tests, the results of which are tabulated with explanation and discussion. An account of the preliminary tests made at Berkeley is first presented, and this is followed by one of the large-scale sampling and testing done in Los Angeles County.

No consistent difference was noted in the sugar content of sprayed as compared with that of unsprayed fruits. A remarkable and consistent difference was noted in the acid content.

Winter injury investigations (*Nebraska Sta. Rpt.* 1921, p. 9).—It is claimed that from 10 to 15° F. below freezing is a critical temperature for apple tree roots. Scion roots from wood of standard varieties were found able to withstand more freezing than the stocks upon which trees are ordinarily propagated. Midwinter soil temperatures, taken at 7.5 and 10.5 in. below the surface, are said to occasionally show from 6 to 10° of freezing, and dry soils are more susceptible to atmospheric changes of temperature than are moist soils. This leads to the conclusion that there will be less danger of winter injury to the root systems of apple trees if cultural practices are employed which will tend to keep the soil in a moist condition.

The degeneration of plants propagated asexually, V. DUCOMET (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), July, pp. 255-273).—It was not found in the progress of this work, which dealt chiefly with the potato, that propagation by means of the tubers involved necessarily a lowering of the value of the stock (senescence).

FIELD CROPS.

[**Report of field crops work in Arkansas**] (*Arkansas Sta. Bul.* 181 (1922), pp. 16, 17, 19-41, 42, 43, 83-86, figs. 13).—Cotton varieties and strains which consistently yielded high in experiments by M. Nelson, J. O. Ware, and E. A. Hodson included Deltatype Webber, Webber 49-4, Express, Acala No. 5, Cleve-

land, Triumph, Lone Star, Rowden, and Trice. The results recommend Trice for the northern limit of the cotton section, Triumph on the hills south of the Trice area and on some delta lands where staple is not desired, Lone Star and Rowden on the better hill lands south of the Arkansas River and on bottom lands where bender cotton is wanted, and Acala in the central and southern portion of the State on the better hill lands and on the lighter bottom lands. While Express is the standard staple cotton of the State, in some river bottoms and delta regions where longer staples are desired and the soil is not too heavy, the earlier Webber strains are profitable.

Seed cotton harvested in good condition, ginned, and the seed stored in bulks of 2 or 3 tons or less did not deteriorate, whereas seed, even when harvested in fairly good condition, stored in large bulk tended to heat to the point of injuring the vitality. Gathering seed cotton when wet or damp led to great deterioration of the seed, which heated rapidly after storing, with serious injury to germination. As a result of experiments (E. S. R., 39, p. 739) by Ware and others, close spacing is recommended for general adoption in boll weevil sections. A hoe width between plants is considered practical. Delinting cotton seed with concentrated sulphuric acid was found by J. A. Elliott to control angular leaf spot. Planters designed to drop the delinted seed at certain distances are being tested with the object of avoiding chopping. However, the universal adoption of this method is not advised until further tested.

Sudan grass was found by Nelson and C. K. McClelland to give best returns when seeded shallow with a grain drill, using about 25 lbs. of seed per acre.

The Honey variety of sorghum gave decidedly the largest yields in experiments by Nelson, McClelland, and W. H. Sachs. Wherever acid phosphate was applied to sorghum very profitable increases in yields occurred, and manure alone and reenforced with acid phosphate, gave excellent returns. Sodium nitrate or potash alone did not cause marked yield increases.

Both medium and mammoth red clover and lespedeza were generally successful, on fall and spring sown grain. Seeding clover on a late snow or on a thawing surface in both winter wheat and winter oats resulted in good stands. Without these conditions, cultivation to give the seed lodgment is considered necessary. A single harrowing before seeding sufficed where the soil was loose, while harrowing before and after seeding was needed on packed soil. Lespedeza sown on the surface of winter-seeded grain without harrowing was a marked success. On spring-seeded grain both red clover and lespedeza sown after the grain drill without harrowing were successful, whereas harrowing the loose soil was detrimental to both crops. Seeding clover in the fall on fall-sown grain did not allow enough time for a start. Due to its habits of growth, bur clover sown on small grain does not succeed. However, it is considered of high promise as a winter legume with both cotton and corn. Investigations indicated that land for alfalfa should be well drained, free from weeds, reasonably fertile, inoculated, and not decidedly acid.

L. W. Osborn obtained best seed and forage production from early strains of Speckled velvet beans. Osceola velvet beans proved very desirable for the central and southern sections of the State, but did not mature seed in the northern part.

Station rye, an improved strain, is said to be fully equal if not superior to Abruzzi for the northern part of Arkansas.

Seeding winter oats in ample season, but not too early, was found to produce a much better start in the fall, and plants with a good root system and a good start would survive the winter where late seeding would fail. Winter oats must be seeded considerably earlier than wheat in any locality. While the open furrow type of drill did not prove superior to the ordinary grain drill,

both methods were better than broadcasting for avoiding winterkilling. The best results in both yield and quality of spring-seeded oats were had from reasonably early seeding. Variety trials by Nelson and Osborn with winter oats show Winter Turf and Culberson superior for the northern half of the State, while strains of Rustproof gave better yields in central and southern Arkansas. Fulghum and Dwarf Culberson are especially suited as winter oats on rich land. Turf oats are preferable over the State for pasture purposes. For spring seeding, Fulghum and strains of Burt gave better results. Varieties of northern origin usually grow large, are late, suffer heavily from rust, usually have light grain, and in case of lodging, can be used only for hay. Pedigreed strains have been developed from selections of winter oats surviving heavy winterkilling.

Corn varieties of southern origin nearly always produced grain of better quality than those of corn-belt origin in tests by Nelson and Osborn. Neal Paymaster, Biggs Seven-ear, U. S. Selection 201, Commercial White, Hildreth, and Boone County White were consistent high yielders in north Arkansas, while prolific varieties excelled in central and southern Arkansas. With abundant rainfall, the medium late or late maturing varieties were practically always out standing, while, under droughty conditions, the medium early varieties often made better yields. Mosby×Hildreth and Surcropper×Hildreth gave consistent increases over the parents. Hastings Prolific×Funk Ninety Day gave progeny appearing intermediate in growth and in time of maturity, and with yields equal to Hastings and much better than that of Funk Ninety-Day.

In 4-ft. rows on good soil, varieties of corn with a long growing period will produce best, in a wet season, with 18-in. spacing, and in a dry season with 36-in. Medium early varieties gave best results with 12-in. spacing in a favorable season and 24 or 30-in. in a dry season. In time of planting tests from April 1 to July 15 early plantings required longer for maturity than later plantings, but usually produced the best yields and the most growth. Little difference was observed in favor of either the check or drill method of planting. Cultivation experiments gave indications that the presence of weeds in corn reduced yields more than any variation in the cultural method. Plats scraped but not cultivated and plats cultivated very shallow, about 1 in., generally yielded somewhat less than plats cultivated to 3 or 4 in. deep. Corn on plats cultivated very shallow or scraped lodged or blew down more than where cultivation was deeper. Deep continuous cultivation, 5 to 6 in., also resulted in a decreased yield. Corn laid by when waist-high did not produce differently than at later stages except in seasons when weeds became abundant in the plats laid by early. Approximately 80 to 85 per cent of a full yield may be obtained when corn is planted in 6-ft. rows, and 60 to 75 per cent in 8-ft. rows, as compared with 4-ft. rows. Legumes reduced the yield of corn most when planted in the row while the corn was young, but seedlings when the corn was 3.5 ft. high did not reduce corn yields materially. Velvet beans decreased the yield of corn more than did cowpeas or soy beans.

Mammoth Yellow, Tar Heel Black, Shanghai, and Virginia soy beans stand out as good yielders of seed; Mammoth Yellow is especially suitable for oil production; and Chiquita, Virginia, Arlington, and Oototan are preferable for forage and hay.

In experiments with potatoes from 400 to 600 lbs. of a fertilizer containing 8 per cent of phosphorus, 3 to 4 per cent of nitrogen, and 0 to 2 per cent of potash has given beneficial results under widely varying soil conditions. Barnyard manure gave excellent results and application the year before potatoes are grown is advised. The crop from a full-crop seed of Triumph was a week to 10 days later than from northern-grown stock, slightly less in yield, and not

quite so free from mosaic as the best strains of northern certified seed. Difficulty experienced by growers in securing a good stand for the fall crop has been overcome by digging the potatoes when the vines are yet green, after the tubers are fully matured but while the skins will still slip. The tubers are shielded from the sun and stored at once in slatted crates in a cool, well-ventilated place for 2 or 4 weeks before cutting and planting as usual. Although Bliss Triumph is grown almost exclusively, tests show that Irish Cobbler is a better and more dependable commercial variety, yielding more, and being easier harvested.

Fertilizer experiments showed that sweet potatoes need about the same type and amount of fertilizer as Irish potatoes, except the nitrogen requirement is somewhat less. Potassium gave only negative results. Land not supplied with humus made only 150 bu., while another part well supplied and fertilized produced over 600 bu. per acre. Nancy Hall and Porto Rico were outstanding as to yields and keeping qualities. To produce the best seed, tubers must be selected with a good performance record for yields as well as disease resistance.

[Report of field crops work in Iowa, 1921] (*Iowa Sta. Rpt. 1921, pp. 11-16, 33-35, 48*).—Experiments with various field crops are reported in continuation of earlier work (E. S. R., 46, p. 326).

A survey indicated the need of inoculating soil for alfalfa in about 90 per cent of the trials, and that lime must be applied on about 70 per cent of Iowa farms before alfalfa is seeded. Turkestan alfalfa was as hardy as Grimm, but gave much lower yields. The greater winter hardiness of Grimm permits four cuttings in an average season, whereas but three can be made safely with common varieties. Little difference in value was apparent between alfalfa strains from the Dakotas, Nebraska, and Kansas, but seed from these States surpassed seed from Utah, Oklahoma, and Mexico. Date-of-seeding tests indicated that stands of alfalfa are very certain when seeded between August 1 and 15 on summer fallow, or after a cultivated crop. Early spring seeding with proper field conditions and a suitable nurse crop also practically assures stands. The earliest short-strawed varieties of oats were found slightly better than barley for nurse crops, whereas midseason oats and spring wheat are considered very unsuitable. From 15 to 20 lbs. of seed per acre is advised.

Findings to date point to seeding soy beans 1 in. apart in 30-in. rows. Soy beans seeded with a grain drill gave best results when cultivated several times with a weeder.

Corn cultivated only once, or not at all, had stalks smaller in diameter and shorter than where cultivation was more frequent, and more smut was observed in the uncultivated part. Apparently the plants were weakened by the presence of weeds and more susceptible to the smut fungus. Sweet corn was found to absorb water much more freely than field corn. On days with high humidity considerable absorption may take place which, coupled with low temperature, may subsequently impair germination. In a comparison of diseased and disease-free seed, seed properly cured and stored showed only a trace of stalk disease. It is indicated that the effective control method is through proper curing of the seed.

The most resistant and long-lived seeds of Iowa weeds were found to be butter print, curled dock, crimson weed, horse nettle, five finger, and the tree, honey locust.

Nitrogenous fertilizer experiments, Delta Branch Station, G. B. WALKER, E. C. EWING, and I. P. TROTTER (*Mississippi Sta. Bul. 207 (1922), pp. 24, figs. 2*).—Fertilizer experiments with cotton in 1921, by Walker and Trotter, included comparisons of different sources of nitrogen and different rates and dates of application of sodium nitrate. Ammonium sulphate applied at the

rate of 75 lbs. per acre gave the best money profit in a test of various sources of nitrogen for cotton, netting \$25.34 per acre. One hundred lbs. of sodium nitrate and 50 lbs. of ammonium nitrate followed with acre profits of \$24.53 and \$20.82, respectively. A 250-lb. application of sodium nitrate led the other rates by a considerable margin. When 50 lbs. of sodium nitrate was applied at planting time and 50 lbs. at the first squares greater profits were shown than with any other time of applying 100 lbs. of sodium nitrate. Results in 1920 were rather inconclusive.

In tests by Ewing on the buckshot soils at Scott, Miss., where the unfertilized crop averaged 1,300 lbs. of seed cotton per acre, 100 and 150 lbs. of sodium nitrate produced average increases of 15 and 20.6 per cent, respectively. The use of sodium nitrate was found to lower the lint percentage slightly, but little difference was noted between the effect of 100 and 150 lbs. The increases secured on loam soil were slightly smaller than those obtained on buckshot soil. Cotton is said to be more subject to severe boll weevil damage on buckshot soil. Differences over the unfertilized check were very small when the plants were poorly cultivated.

While with 100 lbs. of sodium nitrate there was produced on corn a gain of 31.2 per cent, equal to 7.5 bu. per acre, and with 150 lbs. one of 40.1 per cent, equal to 9.6 bu., at the present prices of sodium nitrate and of corn very little profit would be expected from the use of this fertilizer in corn culture as practiced on the average delta plantation.

[Report of field crops work in Nebraska] (*Nebraska Sta. Rpt. 1921, pp. 7, 8, 10, 21, 28-34*).—In corn breeding experiments (E. S. R., 45, p. 531) detasseling or alternate rows in the corn seed plat did not give profitable returns, and competition by increasing the rate of planting in the seed plat failed to increase materially vigor or productivity. Rather long, slender ears, with comparatively smooth, flinty kernels, have outyielded the larger ears with deep and starchy kernels by about 4 bu. per acre.

Most of the potatoes grown under irrigation in western Nebraska were not found suitable for seed purposes, but tubers grown under dry-land conditions, from well selected stock, were considered equal for seed purposes to potatoes from any other region of the United States. Seed from Triumph potatoes grown under irrigation for 1, 2, and 3 years yielded 50, 58.5, and 72.2 per cent less than seed grown under dry land conditions. Where 6 varieties were grown on dry land and on irrigated farms, seed from stock irrigated 1 year produced 10 per cent less than the dry-land seed for the same variety, and that irrigated 2 years produced 30 per cent less than the dry-land seed. An experiment where tuber line strains of potatoes were used indicated that potatoes grown on dry land were superior for seed to those given even light irrigation, and the latter were superior to those receiving medium or heavier irrigation. Triumph, Early Ohio, and Irish Cobbler seem superior as commercial table stock varieties for dry-land areas.

Winter wheat yields at North Platte were in accord with those of previous years, indicating that intensive practices can be expected to give but a small increase over wheat following corn in years when the weather conditions are favorable. The work with spring grains bears out earlier conclusions (E. S. R., 41, p. 36). Native corn varieties proved superior to introduced varieties for grain production, but the use of introduced seed of larger and later varieties under irrigation has produced gains of from 20 to 50 per cent in tonnage of silage. Kanred wheat showed itself superior to other varieties in yielding qualities, rust resistance, and winter hardiness, and durum varieties on account of greater rust resistance have substantially outyielded the common varieties of spring wheat. Early varieties of oats produced more than later

varieties. Half stand corn, secured by planting only alternate rows, yielded 25 per cent less than the full stand. Pump irrigation was especially valuable in establishing new stands of alfalfa.

Variety trials were conducted at Valentine with sorghums, millet, spring and winter cereals, miscellaneous forage crops, legumes, and soy beans. Early planted sunflowers gave twice the tonnage produced by corn.

Sugar beets on untreated plats, manured, and after alfalfa, at Scottsbluff (E. S. R., 45, p. 530), produced 6-year average yields of 10.36, 16.75, and 16.1 tons per acre, respectively. Comparative yields indicated that disking may be substituted for plowing when the land for sugar beets can not be plowed early. Potatoes have averaged 57 bu. more after application of barnyard manure and 142 bu. more after alfalfa than on untreated plats.

[Report of field crops work in Rhode Island, 1921] (*Rhode Island Sta. Rpt. 1921*, pp. 5-8, 9).—Comparisons of varieties of soy beans for silage, and different legumes in drills with corn, trials of corn and potato varieties and hybrids, studies of plant needs and differences and of the effect of crops on each other, and the progress of rotations are described in continuation of work noted earlier (E. S. R., 46, p. 226).

Plant propagation (*Rhode Island Sta. Rpt. 1921*, pp. 11, 12).—Irish Cobbler potatoes from home-grown seed were again (E. S. R., 46, p. 227) inferior. Seed grown in the North in 1920, 1919, 1917, and 1916 produced 175, 136, 86, and 86 bu. per acre, respectively. In the long season of 1921, little difference was noted in the maturity of corn, whether planted April 27 or a month later; seed of Rhode Island White Cap corn selected in the usual way was scarcely inferior to seed selected by other methods; and the yields from topped corn and shocked corn did not differ greatly.

Fertilizer experiments with cotton at Clemson College, C. P. BLACKWELL (*South Carolina Sta. Bul. 211* (1922), pp. 22, fig. 1).—The results of fertilizer tests with cotton grown continuously for 13 crops on a Cecil sandy loam, typical of the Piedmont section of South Carolina, are summarized. The earlier years of the experiment have been recorded (E. S. R., 38, p. 533).

Applications of fertilizer carrying large amounts of nitrogen or phosphoric acid seem to have a residual effect lasting for several years. Phosphorus is indicated as the first limiting factor on the particular soil and nitrogen a close second. Although potash gave small increases on some plats, it is considered of doubtful value. Lime reduced yields slightly when used with acid alone and caused a slight increase when employed with a complete fertilizer. Its use on this soil for the production of cotton alone would not seem profitable. Acid phosphate with blood gave better results than any other combination of two elements. Eight tons of stable manure and from 352 to 848 lbs. of acid phosphate produced the highest yields, 1,312 lbs. of seed cotton per acre, of the several treatments used. Plats receiving heavy applications of acid phosphate and nitrogen, with generally some potash, maintained high yields to the end of the experiment. It has been found very difficult to maintain the yield of cotton on this soil by the use of commercial fertilizer alone.

[Report of the work of] **the British Cotton Growing Association** (*Brit. Cotton Growing Assoc. [Pub.] 77* (1922), pp. 38, pls. 11).—The status of cotton production in the British possessions is reported in summary form for the year 1921.

The potato and the Jerusalem artichoke, L. BRÉTIGNIÈRE (*La Pomme de Terre; le Topinambour. Paris: Libr. Agr. Maison Rustique*, [1922], pp. 200+2, figs. 26).—A popular treatise on the culture of the potato and the Jerusalem artichoke.

Wild rice, C. E. CHAMBLISS (*U. S. Dept. Agr., Dept. Circ. 229 (1922), pp. 16, figs. 9*).—Descriptions of wild rice (*Zizania aquatica*, *Z. palustris*) and its habitat are given with instructions for growing and harvesting the crop and storing seed. The use of the crop as food for birds and man, and its possible forage and ornamental value are indicated briefly.

[**Sugar cane experiments in Hawaii**], H. P. AGEE (*Hawaii, Sugar Planters' Assoc. Proc., 41 (1921), pp. 233-236*)—Practical information gained from 10 years of field experiments is summarized.

With a 2-year crop the best results were obtained when the fertilizer was in 2 or 3 applications, and the yields gradually decreased as the number of applications were increased. With short ratoons the best results were obtained from a single application. In localities suffering from periodic droughts the maximum fertilization is suggested in 4 applications, 2 each year. Two hundred lbs. of nitrogen per acre is considered the basic amount upon which to plan fertilizer practices, and this can be varied as conditions warrant. Only slight response was given phosphates, the largest being on mauka land recently brought under cultivation on Oahu and Kauai. It is felt that in most cases sufficient phosphates are applied in the high-grade fertilizers used. No response was obtained from potash on Maui or Oahu, whereas the soils of the Hilo district require applications of at least 125 lbs. per acre. Kauai as a whole seems well supplied with potash.

Fertilizer experiments with sugar cane [in Tucumán], W. E. CROSS (*Rev. Indus. y Agr. Tucumán, 12 (1921), No. 3-4, pp. 45-57*)—Further data are presented, largely confirming results noted heretofore (*E. S. R., 42, p. 532*).

Tucumán seedling canes in 1921, W. E. CROSS (*Rev. Indus. y Agr. Tucumán, 12 (1921), No. 3-4, pp. 58-62*)—Additional yield data and analyses on sugar cane seedlings produced in Tucumán (*E. S. R., 46, p. 135*) are tabulated and discussed.

The effect of frost on sugar cane buds, G. I. FAWCETT (*Rev. Indus. y Agr. Tucumán, 12 (1921), No. 3-4, pp. 37-39*).—In whole canes of P. O. J. 36 planted immediately, 25 days, and 38 days after heavy frost, 70, 52.2, and 14.6 per cent of the buds, respectively, germinated, indicating a marked reduction in germinability with the passage of time before planting. Buds showed a successive decline in germination according to their location, decreasing from 100 per cent at the base of the stalk to 7 per cent at the seventh and eighth buds, and 0 above. Although analyses showed decidedly less water in the lower buds, it is considered doubtful whether this explains the different reaction to cold.

Methods of growing sunflowers (*Nevada Sta. Rpt. 1921, p. 13*).—Experiments by C. E. Fleming indicated that fall plowing and early planting in rows 3 ft. apart give satisfactory results with sunflowers in western Nevada. The best sunflower silage was produced when the crop was cut with the seeds of 40 per cent or more of the plants in the dough stage, silage was well packed, and enough water used to exclude air. Fermentation started with sour milk yielded silage of better color, odor, and general appearance than silage made without a starter.

The mode of inheritance of certain characters in wheat, J. B. HARRINGTON (*Sci. Agr., 2 (1922), No. 10, pp. 319-324*).—Observations on the F_1 of crosses of Red Bobs with Taylor Wonder, Hard Red Calcutta with Taylor Wonder and with White Bobs, and Commonwealth with Kitchener are reported.

The number of factors for seed color was found to vary with the different varieties and with different strains of the same variety. Segregation for seed color occurred in both 3:1 and 15:1 ratios, red being dominant to white. Kitchener has two factors for seed color, while Hard Red Calcutta and Red Bobs have one in some selected lines and two in others. Seed texture ap-

peared to be governed by several factors, with the distribution in F_2 approximating the extreme range of the parent varieties. Two factors were apparently concerned with the production of fully awned spikes. A single factor was held responsible for the red color of the chaff in Commonwealth \times Kitchener.

An investigation upon certain metrical attributes of wheat plants, F. L. ENGLENDOW and J. P. SHELTON (*Jour. Agr. Sci. [England]*, 12 (1922), No. 2, pp. 197-205).—Measurements on strains of Polish and Kubanka wheats (E. S. R. 44, p. 832) gave evidence that while glume-length and rachis-length in both varieties are very highly correlated, the ratio of the two quantitles varies about as much as the absolute glume-length and appears to be of no special value in investigation. Among the tillers of any one plant, correlations exist for glume-length, rachis-length, and ratio, with the general value of about +0.5. Consequently such observation should be confined to the main stalk of every plant. It is also held desirable to restrict the experimental population to plants producing equal numbers of tillers. Weight of mother seed does not seem to determine appreciably the growth of the resulting plant as indicated by glume-length, rachis-length, and their ratio. Selecting seeds of like weight to reduce fluctuation among the resulting plants seems impracticable.

The genetics of square-headedness and of density in wheat, and the relation of these to other characters, S. BOSHNAKIAN (*New York Cornell Sta. Mem.* 53 (1922), pp. 801-882, pls. 2, figs. 8) —The inheritance of types of internode length in wheat is treated from the viewpoints of analysis of minor segregations within gross segregations, the determination of the interrelations of varied characters, and the determination of characters found to be the resultant of other characters. The material, exclusive of interspecific crosses, consisted of more than 60 F_2 progenies, 14 of which were carried through the F_3 . A brief discussion of the effect of environmental factors on the production of rachis internode characters shows to what extent nongenetic variations may take place. The differences between density and square-headedness have been discussed elsewhere (E. S. R., 38, p. 537).

Square-headedness, the result of a combination of growth characters, showed a complex mode of inheritance. In the F_2 generation plants of degrees of square-headedness ranging from forms distinctly compacted at the tip to forms denser near the base of the ear were obtained. The range of variation in F_2 generally depended on the differences between the extremes of the parental ranges, and the means of the F_2 approached the parental means. The F_2 usually had a higher coefficient than the parental means. Some F_2 progeny of two nonsquarehead parents were even distinctly squareheads, but none of these forms were obtained in F_3 . These variations from normal expectations are ascribed to heterosis and to greater feeding area. A coefficient of correlation of 0.465 ± 0.033 was found between width of culms and square-headedness.

The purely spelt forms were not found to be affected by the factors producing square-headedness, but as the spelts approached the *Triticum sativum* type they were affected to a greater degree (E. S. R., 46, p. 333). Speltoid forms did carry these factors, as many squareheads of varying intensities were found among their *sativum* progeny. It is stated that certain spelts when crossed with a *T. vulgare* form will produce a large number of squareheads in F_2 , while others will yield only nonsquare-headed *T. sativum* forms. Square-head forms have been produced by crossing *T. vulgare* with other wheat species.

The density studies reported were made primarily on the progeny of a number of crosses in which the dense parent was Dale Gloria (*T. compactum*), with an average internode length of about 1.41 mm. Density was found dominant over laxness, with ratios approaching 3:1. The heterozygous forms were somewhat laxer than the homozygous dense forms, but not intermediate

between the dense and the lax parents. The F_2 curves were bimodal and discontinuous. The F_2 plants showed various degrees of density within the dense and the lax classes. Proof is offered to show that these variations are hereditary and are the result of the segregation of modifiers or of additional density factors capable of producing density only within short ranges. Some experimental evidence cited suggests that different density factors form allelomorphous series, and other data intimate that they belong to multiple series.

Square-headedness and density were found to represent two different characters, between which hybrid progenies showed all types and grades of combinations. Although the process of squareheading was found to shorten the average internode length, the effect thus produced on density was slight. The phenotypic transmission of the square-headedness of Dale Gloria is apparently dependent on the type of the lax nonsquarehead parent. In some crosses a large proportion of lax squarehead forms was present in the F_2 , while in others none were found.

Although in F_2 progenies resulting from dense and lax crosses an almost perfect correlation exists between rachis length and density, these two characters are not considered as necessarily correlated. The correlation between density and rachis length diminishes as the difference between the number of internodes of the parental forms increases. The high degrees of correlation found between average internode length and length of culm, length of sterile glumes, and length of kernels, and average rachilla internode length, together with other observations, are held to show that density and the shortening of the other length characters are the result of a single dwarfing factor. Plants exhibiting the spelt character are not affected as much by the density factor as are those showing *T. sativum* characters. It is considered possible to produce compact forms by crossing a lax *T. sativum* with lax forms of other species, and dense forms may also appear occasionally in crosses where neither parent is a *T. sativum*. Compactness is not deemed a characteristic of *T. sativum* forms, as other species also may exhibit this character.

Seed certification, its present status and its significance for agricultural production, K. VON RÜMKE (Mitt. Deut. Landw. Gesell., 37 (1922), No. 13, pp. 207-211).—A review of seed certification work in Germany with a statement of its objects and suggested procedure. A list of 23 titles on the subject is included.

HORTICULTURE.

Fruit and vegetables (Arkansas Sta. Bul. 181 (1922), pp. 71-83, 86, 87, figs. 8).—A general progress report upon the activities of the horticultural division.

Further mention (E. S. R., 45, p. 836) is made of nutritional studies with the apple. The decline in vigor of trees maintained in continuous clean culture is believed to indicate the imperative need of supplying humus in some form, either as cover crops or as manure or, preferably, a combination of both. The quickly available carriers of nitrogen, nitrate of soda and ammonium sulphate, gave better results than the slower forms such as tankage, cottonseed meal, etc. For the apple the best results were obtained by using 25 lbs. of nitrate of soda per tree some three or four weeks before blooming, with a supplemental application of the same amount just previous to the June drop. On soils rich in humus the early application was found sufficient. Phosphorus proved of indirect benefit by stimulating the growth of cover crops, which, in some cases, failed to make a satisfactory development in the absence of the phosphorus application. Acid phosphate applied at the rate of 300 to 400 lbs. every other year has given satisfactory results. Potassium has shown no benefit either in the set of fruit, formation of spurs, or in yield.

Studies with peaches showed that the same general fertilizer principles obtain as with the apple. However, the peach was found more susceptible to nitrogen injury, and it is therefore recommended that the suggested amount for the season, 2.5 to 3 lbs. per tree, be applied in three installments, as follows: Preceding bloom, just before the June drop, and following the harvest. When only one application is given the amount should be reduced to from 1.5 to 2 lbs. per tree. Phosphorus was found to benefit the wood growth and to increase the number of fruit buds which actually set fruit; however, its greatest value was in the stimulation of the cover crop. Potash proved of no benefit to the peach.

Grapes responded less favorably to nitrogen than either the apple or the peach, 100 to 150 lbs. of nitrate of soda per acre proving an abundant application. Acid phosphate used every other year at the rate of 250 to 300 lbs. gave excellent results. Humus, found to be one of the most important factors in fertilizing the grape was supplied as manure or by plowing under cover crops. Pruning studies with the grape indicated that with standard varieties like Concord the best clusters were obtained when about 30 buds, distributed along canes about 7 buds in length, were left on each plant in addition to the spurs for renewal. On normal canes the weight of fruit increased from the first to the third bud, was about the same on the third, fourth, and fifth, and was much reduced on the seventh. The retention of a greater number of buds failed to increase the quantity and tended to reduce the quality. Summer pruning, with the possible exception of removing sucker growths, proved detrimental to the vine. The Concord is recommended as the most important commercial variety. The rotundifolia grapes, such as James, Scuppernong, and others, have not given satisfaction in the Ozark region.

Cane fruits responded favorably to nitrogen fertilizer applied in like amounts as for the grape but divided into two applications, in early spring when growth begins and following harvest. Acid phosphate is recommended at the rate of 300 to 400 lbs. every two years. Humus must be furnished either as manure or as cover crops. Early Harvest blackberry, the most largely grown early variety in northern Arkansas, is susceptible to rust injury. Snyder, a more vigorous grower and less subject to rust, is considered an excellent blackberry for northern Arkansas. McDonald, largely self-sterile and of more or less trailing habit, is considered valuable for southern Arkansas provided it is interplanted with compatible varieties, such as Lawton, Haupt, or Early Harvest. Lawton is recommended for southern Arkansas, while Dallas and Eldorado are considered promising for the northern part of the State.

Small amounts of nitrogen when applied with caution have given good results on the strawberry. It is recommended that 100 to 150 lbs. of nitrate of soda per acre may be used profitably after the harvest, whereas not over 100 lbs. can be applied safely in early spring. The slowly available nitrogen carriers, such as cottonseed meal, dried blood, and bone meal are deemed safer to use on the strawberry, and of these bone meal is considered the best on account of containing both nitrogen and phosphorus. Well-rotted manure is excellent when applied subsequent to harvest. Phosphorus has given better results on the strawberry than on any other fruit, increasing the yield and improving the shipping quality. It should be applied in the form of acid phosphate at the rate of 200 to 300 lbs. per acre per year, or in larger amounts biennially. Klondike is described as the standard strawberry over the greater part of the State. Aroma, ripening 10 days later, is considered an excellent berry, well worthy of replacing a portion of the Klondike acreage.

A single season's work with casein spreaders indicated that the use of these will assist in promoting a more even coating of the spray. The addition of 5 lbs. of freshly slaked limestone or 6 lbs. of hydrated lime to each 50 gal. of lime-sulphur spray assisted in preventing spray injury.

In tests with tomato varieties, Chalk Early Jewel, Bonny Best, and June Pink proved satisfactory early sorts. Greater Baltimore, Red Rock, Livingston Perfection, and Stone were good canning varieties. Straw mulch not only increased the total yield of tomatoes but also lengthened the period of production. Pruning reduced the total yield but lengthened the growing season. Although fruit did not ripen as early on staked vines, production was increased not only in the size of the individual but also in the total weight of marketable fruits.

[Horticultural investigations at the Iowa Station] (*Iowa Sta. Rpt. 1921*, pp. 36, 44, 45, 46, 47, 61, 62).—Without presenting data, various activities of the year are briefly reviewed.

Studies in the pollination of cucurbits indicated that in a number of cases the pollen germinates and enters the style in the usual manner and stimulates the formation of fruits of normal appearance but without seeds. It is thought probable that the pollen may at the same time affect the chemical composition of the fruit and perhaps the flavor.

Among several seedling apples developed at the station, several of which have been considered worthy of naming and dissemination for more extended trial, the Ames, a red apple of good quality and good keeping characters, is deemed especially promising. Two pears developed at the fruit breeding farm at Charles City are considered meritorious, both on account of regular bearing and ability to resist cold, which at times reaches 40° F below zero. One of these pears was obtained by crossing Orel 15 with Anjou, and the other is an open-pollinated seedling of Seckel.

In studies in the compatibility of stock and scion in the apple, in which several standard varieties were grafted on different hardy stocks, it was found in the case of Grimes Golden scions grafted on 20 different stocks that marked variations exist in the growth of scion on the different roots, and that these differences are correlated with the type of graft union. Virginia Crab, Hibernial, and Shields have been found to be superior stocks for certain commercial apple varieties which exhibit weakness in the trunk and crotch.

Cold storage tests conducted to determine the best method of keeping apples showed that many of the more serious storage troubles may be controlled by proper handling of the fruit. In the case of Jonathan, forced circulation of air in the storage rooms prevented soft scald. Spotting of stored Jonathans was prevented by earlier picking, followed by immediate placing in storage chambers. Grimes Golden, on the contrary, kept better when picked as nearly ripe as possible. It is advised that Grimes Golden should not be held in storage later than January 1.

In a progress statement (E. S. R., 46, p. 334) regarding soil management studies in an apple orchard near Council Bluffs, it is stated that Northwestern Greenings growing in clover sod have produced an increased yield of 3 bu. per tree per year over a 10-year period above that of similar trees in blue grass sod. The terminal growth of the trees in the blue grass sod apparently lacked sufficient vigor to form lateral fruit buds, and the buds at the base of the leaf on such growth very seldom were strong enough to push out new growths the following year. Sunlight is deemed a potent factor in promoting fruit production.

Celery growing, W. R. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1269 (1922)*, pp. 32, figs. 20).—This bulletin, discussing the fundamentals of celery production, is for the most part a revision of an earlier paper by the same author (*E. S. R.*, 18, p. 1047). The information on celery diseases and their control was prepared by I. C. Jagger and W. W. Gilbert.

Studies in fruit pollination, D. CASELLA (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 11-12, pp. 474-496).—Following a preliminary discussion on the importance of proper pollination in fruit orchards, the author reports in this paper on extended investigations concerning factors involved in the pollination and the setting of fruit flowers.

Observations indicated that the mulberry and the grape are anemophilous, while species belonging to the rose family were for the most part entomophilous. Weather was found to be a potent factor in pollination. In the grape, for example, rain was found to cause the cap or calyptrium to adhere to the stigma and thus prevent pollination, while in the rosaceous plants rain caused the stamens to cling to the style, thereby keeping the stigma wet and preventing its normal development. When rain was followed by bright weather the stamens quickly dried and resumed their natural position. Microscopical examination of almond flowers following a period of rainy weather showed some dead stigmas and more or less bursted pollen grains in the anthers.

The shape and size of pollen grains was found to vary among species, in certain cases among varieties within a species, and sometimes even among the grains present in a single anther. Similar differences were recorded in the color of the pollen. In species of *Prunus* the color was yellow or more or less orange, in *Pyrus* greenish yellow, in *Vitis* more or less intense yellow, and in *Morus* white. The color of all pollen was more intense when dry. The maximum and minimum dimensions are given in tabular form for pollen of the almond, peach, apricot, plum, pear, apple, grape, and mulberry.

It was found that pollen would develop rapidly in the stigmatic fluid of the same species. In growing pollen of various fruits in different strength sugar solutions, each species was found to have a specific requirement, almond 20 per cent, grape and pear 15, and apple 10 per cent. It was observed that the pollen of each fruit had a characteristic habit of growth. For example, in the grape a small bubble-like enlargement was always formed at the base of the pollen tube. Finding the optimum thermal point for the growth of almond pollen to be 59° F. and for grape pollen 68°, the author concludes that early blooming fruits have a lower temperature requirement than late blooming species. In comparing the natural set of fruit on Madeleine d'Angevine, a sterile grape variety, with that obtained by crossing with a potent male, it was found that in the first instance only scattering, loose clusters were formed, while in the second the clusters were full and perfect.

From a study of the viability of the pollen of many varieties and species, the author concludes that the average germination is quite constant within varieties and species. Bitter almond pollen placed in test tubes exposed to different environments, full light, darkness, and drying chemicals, did not retain its viability in any of these situations as satisfactorily as did pollen on blooms kept in vases of water.

To determine the effect of various fungicidal and insecticidal materials on the development of pollen, grains of various fruits were placed in solutions of Bordeaux, copper sulphate, arsenate of lead, sulphur, etc., with sugar solutions as a check. Pollen failed to germinate in the copper solution, was retarded in sulphur, and germinated very well in lead arsenate. In order to determine the effect of various spray mixtures on the setting of flowers, emasculated grape clusters treated with various chemical solutions were dusted with pollen of a

compatible variety. In all cases the chemicals commonly used as insecticides and fungicides interfered materially with the setting of the blooms.

The author records various abnormalities observed in the growth of various fruit pollens in artificial media.

Results from self-pollination of apple flowers, C. S. CRANDALL (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 95-100).—A statistical analysis of the results of self-pollination tests conducted at the Illinois Experiment Station since 1909 with various species, varieties, and hybrid forms of the apple. Of a grand total of 10,848 blossoms self-pollinated, 910 set fruit. In discussing the results of the work, the author presents the material in three sections, (1) orchard varieties, (2) species, and (3) hybrid forms.

Of the 30 orchard varieties utilized in the experiments, 23, representing 1,119 pollinations, failed to set any fruit. The remaining 7, represented by 457 pollinations, bore 73 fruits containing a total of 295 seeds, 180 of which germinated. Among those varieties failing to develop fruit were such well-known kinds as Jonathan, Oldenburg, Stayman, Winesap, and Grimes Golden. The successful varieties, Longfield, Oliver, Tolman Sweet, Wythe, and Yellow Transparent, are represented by 98 living seedlings, only 11 of which are of sufficient vigor to be classed as good.

Of the 47 crab or crab-like forms utilized in the study, only 15 are represented by living seedlings, ranging from one to nine years in age and in general of such poor vigor that only 19 are classed as good.

Little success was obtained in selfing hybrid seedlings, for only 53 fruits were obtained from a total of 1,409 blossoms pollinated on 40 different hybrid forms.

A study of the data shows that in general self-pollination was decidedly unsatisfactory both in number and vigor of seedlings. Somewhat better success was obtained with the orchard varieties than with either of the other two groups.

Apple pollen and pollination studies in Maryland, E. C. AUCHTER (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 51-80).—Various phases of an investigation of factors concerned in the successful pollination of the apple are discussed in this comprehensive report of work carried on at the Maryland Experiment Station during the three years 1919-1921.

In a determination of the value of brushing flowers after inclosure in paper sacks in self-pollination studies, comparative counts were made of the set of fruit obtained from brushed, unbrushed, and normally exposed blossoms. The largest set of fruit was recorded in the openly exposed flowers, with little or no difference between the brushed and unbrushed blooms, leading the author to conclude that brushing is a useless operation.

In intersterility studies with various important Maryland apples, Stayman proved to be a highly sterile sort, no fruit being obtained when this variety was used as a pollen parent except in the case of Grimes Golden \times Stayman. In general, all members of the Winesap group showed marked sterility. Similar studies with early maturing varieties such as Early Ripe, Red Astrachan, Red June, etc., in the spring of 1919 gave much better results. A chart based on data obtained over an eight-year period is presented showing the average duration of the blooming period of 107 varieties of apples growing on the station grounds. An examination of 66 varieties in 1919 and 1920 showed that 12 were self-fruitful, 9 partially so, and 45 self-sterile. Pollen of 19 different varieties applied to the blossoms of a 20-year-old Lawver tree in the spring of 1920 resulted in fruit in only five instances, indicating quite definitely that the variety of pollen parent is an important factor in promoting successful pollination.

Studies of the comparative germination of pollen placed in different strength sugar solutions showed a high percentage of viability in almost all cases. The pollen of Stayman and Arkansas, however, showed practically no germination. Of the four different sugar strengths tested, namely, 2, 5, 10, and 15 per cent, the 10 per cent gave somewhat the better results. No significant morphological differences were noted in the 15 varieties studied. In a study of the comparative value of large and small buds as a source of pollen, much better results were obtained from the use of pollen obtained from the more advanced buds. Again, in a test of large, medium, and small buds as material for emasculating and crossing, much better success was obtained with large and medium than with the small buds.

To determine the effect of the length of time elapsing between emasculation and pollination, several hundred buds were emasculated on the same day on a single tree, and were so divided that some were pollinated immediately and others at intervals of 1, 2, 3, 4, and 5 days. The pollen used was obtained fresh each day from buds of a single tree. The results in terms of percentage of fruit set were as follows: 1920, immediate 30.76 per cent, 1 day 16.16, 2 days 6.8, 3 days 0, 4 days 0.96, 5 days 3.96; 1921, immediate 10.34, 1 day 7.81, 2 days 12, 3 days 4.76, and 4 days 5.76 per cent, from which data the author concludes that in general immediate pollination is most satisfactory, particularly during a warm, clear period. Grimes Golden pollen of 1, 2, 3, 4, and 5 days' age, when used on blossoms of a single tree, gave respective sets of fruit of 5.88, 2.97, 5.3, 3.52, and 2.61 per cent.

That pollen is much more resistant to cold than are the pistils was indicated in the examination of apple blooms following two freezing nights (20 and 22° F.) in the spring of 1921. In this case the pistils were killed, while the pollen, although germinating somewhat slower than usual, was found of satisfactory viability.

A brief test of the influence of time of day on success of pollination did not indicate any material advantage in favor of any one period.

An extended list of citations to the literature is appended.

The set of fruit in apple crosses, M. J. DORSEY (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 82-94).—The apple-breeding operations reported upon in this paper were conducted in a greenhouse on the Minnesota Fruit Breeding Farm, utilizing tub-grown trees which had been stored in an unheated cellar during the winter. In addition to avoiding frost and inclement weather, it was possible by introducing trees at various times not only to lengthen the period of operations but also to insure compatibility in time of bloom. Furthermore, bagging was considered unnecessary on account of the absence of insects.

An alphabetically arranged tabulation of three years' records, 1918-1920, for 277 apple crosses shows a general range of 0 to 30 per cent in fruit set. However, in a few instances, for example, Jonathan×Patten Greening (57.7 per cent) and Oldenburg (Duchess)×Jonathan (51.5 per cent), much better success was obtained. Of a grand total of 27,950 blossoms pollinated, 10.3 per cent set fruit, but only 5.6 per cent reached the mature fruit stage. An unexpected number of crosses failed absolutely. In analyzing the performance of individual trees from year to year an apparent alternation in bearing, quite independent of the amount of bloom, was observed in certain instances, e. g., in certain of the King David×Oldenburg crosses.

The important rôle of the pollen parent was indicated by a comparison of the set of fruit obtained when Oldenburg, Delicious, Jonathan, and Wealthy were used as pollen parents on a single variety, the results in per cent of matured fruits being 5.65, 9.28, 11.91, and 6.41 per cent, respectively. Only three mature

fruits were obtained in self-pollination studies involving a total of 1,065 flowers on trees of 15 different varieties. It is singular that of the three fruits obtained two were Stayman Winesap, a variety generally found to be self-sterile (see above). Of over 200 trees used in the entire study, 55 failed to produce any bloom, and 85 bore flowers more or less abundantly but failed to set any fruit. It is suggested by the author that the absence of bloom or fruit on so large a proportion of the trees may have been due to excessive vegetative development caused by severe pruning and heavy nitration.

Observations on the factors influencing the length of life of apple trees in West Virginia. H. L. CRANE (*Amer. Soc. Hort. Sci. Proc.*, 18 (1921), pp. 207-211). The data upon which the discussion is based were obtained from answers received in response to questionnaires sent out to different fruit men throughout the State. The consensus of opinion of these men was that the short life of apple trees in West Virginia is primarily due to the shallow nature and low fertility of the soils, to insect and disease pests, to climatic conditions favoring the rapid development of trees, and to the early fruiting and heavy producing nature of the varieties generally grown. The importance of the subject is illustrated by reference to a survey conducted in Berkeley and Jefferson Counties, W. Va., which showed that approximately only 1 per cent of the apple trees were over 30 years of age.

Better cherry yields in Wisconsin. R. H. ROBERTS (*Wisconsin Sta. Bul.* 344 (1922), pp. 30, figs. 20) — A report of an investigation in which it was found that production of fruit in the sour cherry is directly correlated with the type of growth. In general, productive trees were characterized by a vigorous growth of new wood each season, from 15 to 18 in on a majority of the terminal branches and main laterals.

Experiments conducted in 1921, a season of light rainfall, indicated that cultivation may be continued to advantage much later than is the usual practice. Observations showed that as a result of the early cessation of tillage the individual fruits of the succeeding crop were smaller and the yields were reduced below those of trees tilled for a longer period.

With the aid of photographs, the author outlines successful methods of pruning sour cherry trees. Severe pruning was found beneficial, not only in the stimulation of active new growth but also in admitting light to the lower part of the tree and thereby promoting an even distribution of fruit. Pruning experiments at Sturgeon Bay, in Door County, the results of which are given in tabular form, show that heavily pruned trees, in spite of having their fruiting area reduced approximately one-third, outyielded unpruned trees. This is accounted for in part by the greater dropping of fruit from the unpruned trees.

In cultural experiments in 1919-1921, it was found that trees respond differently to the same treatment, depending upon the previous history of the orchard, the vegetative condition of the individual tree, and the variety. A study of the results of the test show that fertilizer assisted in maintaining production in strongly vegetative and stimulated production in weakly vegetative trees. Growth and yield were increased following combined pruning and cultivation and following heavy pruning alone. Moderate pruning without fertilizer promoted a slight increase in yield. The use of nitrate of soda increased yield but tended to delay the maturity of fruit.

A study of the yield records of individual trees in a single treatment showed a marked variation in performance, it being evident that certain trees bore consistently light crops while others were consistently heavy producers. The author believes that this variation in individuals may be accounted for in large part by variations in the original root stocks. It is also thought

that the type of blossom bud is closely associated with production, those trees with a high percentage of spur buds being found good producers.

It was found that blossom buds on spurs are harder than those borne laterally along the longer shoots. Pruning and fertilization increased the hardness of buds, as shown by records of the percentages of dead blossom buds on spurs in trees receiving various cultural treatments. The buds on strong growing trees were found more resistant to freezing injury than those on weakly vegetative individuals.

Pollination studies with the Early Richmond and Montmorency showed that both varieties are highly interfertile and self-fertile. It is believed that the wind, although not functioning as a carrier of pollen, is of material assistance in the passage of pollen from the anthers to the stigma. The infrequent occurrence of insects during the blossoming periods of 1920 and 1921 leads to the conclusion that insects are not important factors in sour cherry pollination.

Yield was found to be directly correlated with the number of spur buds which in turn were found to be correlated with the vigor of the tree. The greater productivity and more regular bearing habit of Montmorency, as compared with Early Richmond, is explained by the fact that in the Montmorency spurs form blossom buds the same year that they bear fruit, while in the Early Richmond this concurrence of activities is rather the exception. It is emphasized that the results of cultural treatments may not necessarily be manifested until two or three years subsequent to the beginning of the treatment.

Landscape gardening, F. A. WAUGH (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, pp. XXI+344, figs. 169*).—This is a well-illustrated text designed for the guidance of nonprofessional students in landscape gardening.

FORESTRY.

Research methods in the study of forest environment, C. G. BATES and R. ZON (*U. S. Dept. Agr. Bul. 1059 (1922), pp. 209, figs. 14*).—A handbook of technical information designed primarily for the forest investigator engaged in studies of an ecological nature. The material is presented with the object of assisting not so much through the medium of rules and outlines as through discussion of the fundamental sciences upon which forest growth is based, through the presentation of applicable results obtained by investigators in related fields, and through the suggestion of methods of attacking forest problems of various kinds.

Following a brief introductory statement relative to the scope of the work, the need of permanent forest experiment stations, and the physico-physiological concept of plant life, the authors discuss in an exhaustive manner the measurement of various environmental factors such as light, temperature, precipitation, humidity, evaporation, wind movement, composition of the soil, soil moisture, etc., which affect the development of forest vegetation. The operation of special apparatus useful in the conducting of ecological studies is discussed, and formulas and methods are outlined for the interpretation of observations. Tables for computing vapor and osmotic pressure are appended, together with methods for determining soil acidity and carbonates. A bibliography of 160 titles is presented.

Essential requirements for the practice of forestry, R. D. FORBES (*South. Pine Assoc. Rpt., 7 (1922), pp. 155-163*).—In response to requests for a constructive program for the reforestation of southern pine lands, the U. S. D. A. Forest Service presents the following suggestions based on a careful study of the situation.

Four seed trees of longleaf pine or two seed trees of any other kind of pine should be left standing and uninjured on each acre of land cut over, or an equivalent of 40 or 20 trees on every 10 acres. All tops and slash left in logging should be removed to a distance of 20 ft. from the seed trees, unless twice the prescribed number of seed trees is left per acre, in which case the slash may be left untouched. The slash should be burned the first winter, or carefully protected by patrol and fire lines for 5 years. The cutover lands, when once reseeded, should be rigidly protected from fires at all seasons of the year for 3 years in the case of longleaf pine and for 10 years in the case of other pines, after which less careful protection will be sufficient. Wherever razorback hogs are sufficiently numerous to keep longleaf pine seedlings from reforesting the land the hogs should be excluded, unless the land will reforest to other kinds of pine.

Some characteristics of seeds of coniferous trees from the Pacific Northwest. J. A. LARSEN (*Natl. Nurseryman*, 30 (1922), No. 9, pp. 246-249, *figs* 2) - Data are presented in this article upon miscellaneous experiments relating to the storage, extraction, germination, and longevity of forest seeds, conducted for the most part at the Priest River Forest Experiment Station, U. S. D. A., in northern Idaho.

Seeds extracted at three intervals from a lot of western white pine (*Pinus monticola*) cones collected while wet in October, 1914, gave the following percentages of germination: Those extracted immediately 31 per cent, after two months 26 per cent, and after three months from 12 to 17 per cent. The supposition that injury to the viability of forest seeds often occurs during the process of extraction from the cones proved correct, in that western yellow pine (*P. ponderosa*) seed taken from cones by sun-drying was 42 per cent viable, while that extracted by artificial heat (120° F) was only 11 per cent viable. In other tests with the same kind of seed, 120° gave 38 per cent, 130° 18.5 per cent, and 140° only 1.3 per cent germination. J. St. J. Benedict obtained the following germinations in 35 days with seed extracted without the use of artificial heat: Western white pine 5 per cent, western yellow pine 55, lodgepole pine (*P. contorta murrayana*) 30, and Douglas fir (*Pseudotsuga taxifolia*) 12 per cent. On the other hand, with western white pine extracted at 190° he found no viable seed, with western yellow pine at 169° 6 per cent, with lodgepole pine at 152° 8 per cent, and with Douglas fir at 166° no germination. A kiln temperature of 110° is considered the maximum for extraction.

The influence of the moisture content of the air within the extraction chamber is shown by results obtained by J. V. Hofmann at the Wud River Forest Experiment Station, U. S. D. A., at Carson, Wash. He found that western white pine seed extracted for 10 hours in dry air was 84 per cent viable, as compared with 48 per cent for the same seed extracted in saturated air of the same temperature and for the same length of time. The results with Douglas fir were 73 and 24 per cent, respectively. The importance of uniform conditions in conducting seed tests was shown in a test of two parallel lots of western yellow pine seed placed in wooden trays, one of which was heavier, causing thereby a higher moisture content and lower soil temperature. The actual difference in soil temperature was only 2° , yet the germination in the colder soil was 10 per cent less. The application of a solution of $\frac{1}{8}$ oz. of sulphuric acid in a gallon of water to each square foot of surface of seed flats placed in a greenhouse decreased the germination of lodgepole pine and larch 22 per cent, hemlock 97, Douglas fir 18, western white pine 11, and western red cedar (*Thuja plicata*) 100 per cent. Spruce was only slightly injured. The growth of the seedlings in the treated plats was poor, and the

roots were found to be severely injured. A daily mean temperature of from 70 to 80° was found most satisfactory for germination. The total germination and rate of germination are given in tabular form for nine species of conifers. Of several methods of hastening germination, including treatment with sulphuric acid, mechanical abrasion, etc., that of mixing seed with clean sawdust and keeping the mixture in a warm place for three weeks is deemed the most effective and safest practice.

In a study of the annual rate of deterioration of seeds held in glass-stoppered bottles in a room heated during the day only, only one species, *T. plicata*, exceeded 10 per cent. The Engelmann spruce (*Picea engelmanni*) lost viability at the rate of 25 per cent per year. The place of origin was found to have an effect upon the viability of seed in that western yellow pine from the Colville National Forest was 68 per cent viable after 8 years, as compared with 54.4 per cent after 7 years for seed of the same species from the Helena National Forest.

Seed of the same species from different sections was found to vary in the number of individuals per pound. Yellow pine from the Colville National Forest contained 8,000 seeds per pound as compared with 19,000 seeds for similar seed from the Black Hills National Forest.

Report of the forest branch of the Department of Lands, British Columbia, for the year ending December 31, 1921, P. Z. CAVERHILL, T. P. MACKENZIE, ET AL. (*Brit. Columbia Dept. Lands Forest Branch Rpt 1921*, pp. 55, figs. 13).--Similarly to that of preceding years (E. S. R., 44, p. 838), this report contains data concerning the production of lumber and other forest products, the activities of the forest service, and miscellaneous administrative data.

Annual administration report of the Forest Department of the Madras Presidency for the year ending March 31, 1921, S. COX, D. T. BARRY, C. E. C. FISCHER, H. A. LATHAM, H. F. A. WOOD, H. TIREMAN, ET AL. (*Madras Forest Dept., Ann. Admin. Rpt., 1921*, pp. 83+I.VIII+11).--In addition to the report of the chief conservator of forests, subreports for the six forest circles relating to alterations in area, revenues, expenditures, and general managerial activities are included, together with the report of the principal of the Madras Forest College at Coimbatore (E. S. R., 46, p. 238).

DISEASES OF PLANTS.

Diseases of plants (*Arkansas Sta. Bul 181 (1922)*, pp. 88-94, figs. 3).--A new disease of cotton due to *Ascochyta gossypii* has been described by J. A. Elliott (E. S. R., 47, p. 447) as occurring in Arkansas. Subsequent investigations have indicated that this disease can be controlled by crop rotation.

Elliott and Crawford have found that the organism causing wilt of cotton can be carried by seed, and they recommend that seed from infected fields should not be used for planting.

A bacterial disease of corn is reported to cause high losses in some regions of the State, all varieties apparently being subject to attack. A description of the disease has already been given by H. R. Rosen (E. S. R., 47, p. 243).

A glume blotch of wheat due to *Septoria nodorum* (E. S. R., 45, p. 445) is said to be of considerable importance in Arkansas. Rosen and Elliott report the occurrence of Australian take-all of wheat in two fields in Washington County, Ark. The affected fields were divided into plats, and some of the treatments gave satisfactory control, increasing the yield from 5 bu. per acre on untreated plats to 30 bu. on treated areas.

The advantage of spraying apple trees for disease control in seasons of no crop is pointed out.

Plant pathology (Idaho Sta. Bul. 129 (1922), pp. 11, 12) -- Investigations are said to show that the temperature and moisture content of the soil at seeding time have had a very definite effect on the amount of smut present in wheat at harvest. The amount of infection is said to increase as the amount of moisture increases up to saturation. The highest infection also developed at the lowest temperatures.

Studies of potato diseases are briefly reported, and it is stated that mosaic and leaf roll are becoming very common in the State. From the study of calico and russet dwarf of the potato, it is believed that the calico disease is transmitted only by diseased tubers, while russet dwarf appears to be carried not only by the tubers but also spreads from plant to plant in the field.

[**Report on plant pathology work at the Iowa Station**] (*Iowa Sta. Rpt. 1921, pp. 30-33*). -- A brief account is given of experiments for the control of crown gall on apple grafts, the data being essentially the same as previously reported (E. S. R., 47, p. 354). It is also stated that serious injury to apple grafts is due to blotch caused by *Phyllosticta solitaria* and an undescribed species of *Phoma*.

The work in producing cabbage resistance to yellows is briefly summarized, and it is stated that a strain of Copenhagen Market type has been developed and that there was sufficient seed on hand for further selection work. In connection with the development of resistant strains, a method has been found whereby it is not necessary to grow plants to maturity to determine their desirability.

Notes are given on corn ear mold, which is caused by various fungi, especially *Diplodia zeae*. It is stated that *D. zeae* grows best at a temperature of 86° F. but shows no growth at 55°. Studies show that the fungus causing dry rot of the ears made its entrance into the stalk at the nodes.

A summary account is given of an investigation of mosaic diseases of several truck crops, and successful inoculations have been made within plant families. In connection with these investigations it was found that the mosaic could overwinter in the perennial parts of *Physalis longifolia*. Studies on control measures are said to indicate that regaling the fields, combined with methods for combating insects, will hold mosaic in check.

In connection with studies on crown rust of oats, it is claimed that rust collections on oats from different localities respond differently on the same varieties of oats in the greenhouse. A very marked demonstration of the spread and destruction by crown rust from its alternate host, *Rhamnus cathartica*, grown as a hedge, is reported.

Annual report of the botanical experiment station, [R.] Ewert (*Landw. Jahrb., 52 (1919), Ergänzungsbd. 1, pp. 105-121, figs. 17*). -- This report deals with coal tar emanation injury to plants as distinguished from acute forms of injury due to other gases or smoke, the cause (*Cryptomyces pteridis*) of a fern leaf roll, the Monilia of sweet and that of sour cherry, experiments with Peroxid, effects of defoliation on the growth of plants, a conifer seedling disease, growth anomalies in maize, frost injury to young potato plants, and injury to plants by smoke and by cement dust.

[**Plant disease investigations at Geisenheim Station**], G. LÜSTNER (*Landw. Jahrb., 52 (1919), Ergänzungsbd. 1, pp. 133-145, figs. 2*). -- These sections refer to the biology of *Plasmopara viticola*; a ring spot disease of grape leaves; sulphur and other protectives against grape mildew; Peroxid employed against *Peronospora*, and a preparation of this fungicide and one of mercury chlorophenol against *Fusicladium* and *Peronospora*; control of *Peronospora* with Cupron, also with three new fungicides; studies on the control of the American gooseberry mildew (*Sphaerotheca mors-uvae*); a new fungus disease (*Didym-*

mella applanata) of raspberry; and preservation of fruits with Boloform (para-formaldehyde).

Spraying v. dusting, C. F. PETCH (*Sci. Agr.*, 1 (1921), No. 4, pp. 171, 172).—Considering the handicap of 30 years' priority under which the dusting system works as compared with spraying, and the rapid progress of spraying during the previous 8 years, the author claims that the results of experimental dusting, as indicated for New York, Michigan, Illinois, Nova Scotia, and Quebec, show dusting to be as efficient as spraying in the control of apple scab and biting insects. The cost of the two methods has been practically the same under conditions prevailing in Quebec. The two important insecticides, calcium arsenate and lead arsenate, may be safely used with either system, though dusting is probably inferior for sucking insects.

Results from sprays lacking copper, E. FOEX (*Soc. Path. Veg. France, Bul.*, 8 (1921), No. 3, pp. 112-118).—Information is briefly outlined as presented by different authors regarding the efficacy of fungicidal action obtained or observed during 1921 in case of sprays containing little or no copper.

The immunization of plants, G. P. McROSTIE (*Sci. Agr.*, 1 (1921), No. 3, pp. 122-124, figs. 4).—The chief means at present available for securing at least partial freedom of economic plants from attack by disease organisms, namely, artificial immunization by application on or within the plant of chemical substances, or natural immunization secured by the direct isolation of resistant individuals, or by hybridization followed by selection of resistant and otherwise desirable strains, are illustratively discussed with some 20 references.

***Tilletia texana* in Missouri**, H. R. ROSEN (*Ann. Missouri Bot. Gard.*, 8 (1921), No. 4, pp. 357-359).—The author reports observations made in the Missouri Botanical Garden on a smut of *Hordeum pusillum*, which apparently has been reported only once before, and in that case from Texas. The Missouri material is mentioned as of possible assistance in fixing the identity of this species, as well as calling attention to a new host and a new locality.

The smut was collected by C. H. Demetrio, near Emma, Saline County, Mo., on June 20 1896, and it is noted that while the host of the type collection is *H. nodosum* (*H. pratense*), the collection under discussion is on *H. pusillum*. The relation of *T. texana* to other species is given brief consideration.

A study of the environmental conditions influencing the development of stem rust in the absence of an alternate host (*Nebraska Sta. Rpt.* 1921, p. 13).—A brief account is given of investigations carried on during the fall, winter, and spring which are said to prove that under conditions prevailing at Lincoln during the past winter season, the urediniospores of stem rust do not winter over and produce infection in the spring. Orange leaf rust, on the other hand, was found on a number of cereals throughout the winter. Further observations showed that while the barberry was infected rather early in the season, the spread of rust from this host was very slow, and indications point to the fact that stem rust came in from the South rather than spread from the barberry.

A preliminary note on the occurrence of biologic forms of wheat stem rust in western Canada, M. NEWTON (*Sci. Agr.*, 1 (1921), No. 5, p. 213).—The present work was undertaken and has been carried on for two years to discover and isolate any biologic forms of wheat stem rust which may occur in the grain-growing areas of western Canada. Ilusts from 43 different regions of Manitoba, Saskatchewan, and Alberta have been tested. Great differences have been observed in the susceptibility of wheat varieties to rust from different localities, a few examples of which are cited. A rather virulent strain was found to be quite widely distributed, being found in 17 localities.

Observations of the dissemination of the barberry, F. D. KERN (*Ecology*, 2 (1921), No. 3, pp. 211-214).—Discussion refers to the identity and importance of agencies (including man's activities) concerned in the introduction and spread of the barberry (*Berberis vulgaris*) causing wheat rust.

The eelworm disease of red clover, R. H. SMITH (*Idaho Sta. Bul.* 130 (1922), pp. 3-14, figs. 6).—A form of winterkilling of red clover which is said to be the cause of considerable loss to farmers in southern Idaho is described. The disease in question is caused by *Tylenchus dipsaci*, which is thought to have been introduced through clover seed imported from European countries. The characteristics of the disease are described at some length, and a brief account is given of experiments to determine the range of host plants.

In 1919 a one-acre plat of badly diseased red clover was plowed and planted to potatoes, peas, beans, onions, and rye. In a few instances small galls were observed on the beans as they came through the ground, and a few plants succumbed to the attack, but the majority of the beans overcame the injury. No injury was noticed on any of the other plants. Flower pots were filled with soil removed from around the crowns of diseased red clover plants and also parts of the crowns of diseased plants were shredded into the pots, after which the seeds of peas, beans, onions, several varieties of alfalfa and clover, vetch, sweet clover, rye, wheat, and oats were seeded in the pots. Slight infection in the form of swellings and brown spots were noticed on beans, peas, fall vetch, Egyptian clover, and alsike clover, but, with few exceptions, the plants recovered from the attack.

The author claims that dissemination of the nematodes is largely through irrigation water, but that it is also carried to some extent in fragments of clover plants which accompany the seed. For control measures the most dependable method is believed to be that of rotation.

[A destructive disease of maize in Java], C. J. J. VAN HALL (*Teyssmannia*, 31 (1920), No. 9, pp. 419, 420).—The destructive prevalence in Java is noted of the maize disease due to *Sclerospora javanica*.

A bacterial rosette disease of lettuce, R. C. THOMAS (*Ohio Sta. Bul.* 359 (1922), pp. 197-214, figs. 8).—A detailed account is given of a lettuce disease, a preliminary report of which has been noted (E. S. R., 42, p. 845). The disease has been found in a number of greenhouses in Ohio, and inoculation experiments have demonstrated the pathogenicity of a bacterium which has, in every case, been associated with the disease. Studies of the organism in culture have revealed points of similarity and difference between it and another bacterial disease of lettuce, a disease previously described as due to *Bacterium vitians* (E. S. R., 39, p. 455). *B. vitians* is said to produce spots on the leaves and a rot of the stems of inoculated plants, while the one described by the author was found to gain entrance from the soil through the root system and cause a rosette type of growth. The name *Aplanobacter rhizoctonia* n. sp. is suggested for the organism, and a technical description is given of it.

Drenching the soil with formaldehyde was found to destroy the organism, and this method of treatment is recommended where it is not possible to employ steam sterilization.

Anthraxnose of muskmelons, G. K. K. LINK and F. C. MEIER (*U. S. Dept. Agr., Dept. Circ.* 217 (1922), pp. 4, pl. 1).—A popular description is given of anthracnose of muskmelons caused by *Colletotrichum lagenarium*. For the control of this disease the use of disease-free seed, seed disinfection, and spraying with Bordeaux mixture are recommended.

Potato diseases, J. BEAUVIERE (*Rev. Gén. Sci.*, 32 (1921), No. 6, pp. 175-182, figs. 7).—Potato leaf roll and mosaic are dealt with as to occurrence, spread, causation, symptoms, and prevention.

The contest against potato degeneration, C. PERRET (*Vie Agr. et Rurale*, 19 (1921), No. 37, pp. 180-185, figs. 5).—The complex question of degeneration is discussed in brief systematic detail in connection with the several disease forms and their known or supposed causes.

Potato deterioration, F. ROAS (*Ztschr. Pflanzenkrankh.*, 29 (1919), No. 5-6, pp. 171-176).—Investigations still in progress, directed particularly to the study of a potato leaf crinkle disease and incidentally to the study of leaf roll, have shown almost without exception a deficiency of acid in the diseased plants. From this it is inferred that in the diseased plants the metabolic processes related to acidity are abnormal.

Nitrogen assimilation is also altered, both quantitatively and qualitatively, the plants affected containing more or less amino acid, which was absent from the controls. The same appears from the (scant) data to be true as regards catalase.

A study of Fusarium wilt and tuber rot of Irish potatoes in reference to the relation of the environmental conditions to the infection and progress of the disease (*Nebraska Sta. Rpt.* 1921, pp. 13, 14).—In continuation of a previous publication (E. S. R., 46, p. 146), notes are given of studies of Fusarium wilt in which three strains of *F. oxysporum*, as well as a new strain isolated in Nebraska, were studied.

Striking differences were noted in the symptoms of the disease under dry land and irrigation conditions, and the prevailing type of infection found in Nebraska is from the soil rather than from infected seed tubers. The temperature and moisture relations of the organisms were studied, and the results indicate that a change either in the moisture content or the soil temperature creates a condition under which the plant is more susceptible to the attack of the disease. Different strains of *F. oxysporum* were found to react differently to temperature changes. The new strain of Fusarium is said to show deep vascular browning extending throughout the length of the tubers, and through artificial inoculation it has been found to be a very virulent wilt-producing organism.

Potato leaf roll, F. W. NEGER (*Ztschr. Pflanzenkrankh.*, 29 (1919), No. 1-2, pp. 27-48, figs. 7).—This is chiefly a contribution on the etiology of potato leaf roll and on the physiology of the potato plant.

Potato mosaic, B. BARIBEAU (*Sci. Agr.*, 1 (1921), No. 4, pp. 181-183, figs. 2).—A brief bibliographical account of potato mosaic, as it exists in different parts of Canada, states that in important potato-growing parts of Quebec this progressive hereditary disease is apparent on from 0.5 to 75 per cent of the plants.

Developmental history of Peronospora spinaciae, E. FOEX (*Rev. Gén. Bot.*, 32 (1920), No. 384, pp. 552-560, pls. 2).—This is an analysis, with discussion, of the contribution by Eriksson previously noted (E. S. R., 44, p. 647).

The sizes of the infective particles in the mosaic disease of tobacco, B. M. DUGGAR and J. L. KARRER (*Ann. Missouri Bot. Gard.*, 8 (1921), No. 4, pp. 343-356).—The present investigation is one of a series of studies proposed or in progress on the constitution and behavior of the causal agency in the mosaic disease of tobacco or other plants. The authors explain that the term "agency" rather than "organism" is employed because it is hoped to avoid any possible prejudice to the direction in which such research may lead. The term "virus" is used interchangeably with "agency."

Noting that the agency involved is a filterable virus, as stated by Beijerinck (E. S. R., 10, p. 1058), and confirmed for other plants by Allard (E. S. R., 35, p. 751) and by Doolittle (E. S. R., 44, p. 344), the author has employed some of the methods of ultrafiltration. In general, the method or technique may be divided into three phases: Filtration (or diffusion) of diseased juice

through various ultrafilters, inoculation of healthy plants with the filtrates obtained, and standardization of the filters by a determination of their capacity to permit or prevent the passage of colloidal particles of sizes known, at least approximately.

From the results it appears clear that with approximately equal pressures and equal time intervals the infective particles of the juice of tobacco plants affected with the mosaic disease possess about the same capacity to pass through the pores of porcelain filters as do the colloidal particles of fresh hemoglobin prepared by standard methods. No determinable dilution or loss of infectivity of the tobacco juice was occasioned by filtration through the spherical atomometer cup used in these experiments. On the other hand, a dilution of approximately 50 per cent resulted when a 1 per cent gelatin solution was filtered in the same cup. The sizes of the infective particles would therefore appear to be considerably less than those of gelatin particles, and since the particles of gelatin are not apparently very much larger than those of hemoglobin the conclusion is further strengthened that these infective particles have about the size relations of fresh hemoglobin.

The results of the filtration experiments have suggested the possibility of the existence of minute organisms or propagative parts of organisms in the soil or in other products which are commonly the seat of varied bacterial activities. While this has been previously pursued in certain directions, an investigation of one important aspect of the problem has been undertaken. This work is to be reported upon later.

Black spot of tomato fruits, C. BRICK (*Ztschr. Pflanzenkrank.*, 29 (1919), No. 1-2, pp. 20-26, fig. 1).—A stem-end rot of tomato fruits attributed to *Phoma destructiva* is reported with discussion.

Tomato canker, V. VERBETEN (*Jour. Soc. Natl. Agr. Belg.*, 3 (1921), Nos. 24, pp. 187, 188; 27, pp. 211, 212).—This brief discussion refers to the *Ascochyta* causing a tomato canker in Holland, previously noted by Schoevers (*E. S. R.*, 44, p. 749).

Tomato leaf spot, K. KILLIAN (*Ztschr. Pflanzenkrank.*, 30 (1920), No. 1, pp. 1-17, figs. 7).—Spring infection of tomato with *Septoria lycopersici*, due exclusively to pycnospores from the leaf residues of the previous year, becomes apparent in a moist room in about five days through the discoloration and fall of the cotyledons. About eight days later, spots appear on the underside of the leaves, which after drying give rise to the fruiting bodies. The disease affects the younger and in less degree the older leaves, but not the fruits. The length of the incubation period depends upon the weather, but varies more with the species of the host. Culture studies are detailed, with inferences.

Injuries to the fruit of the apple by agencies other than insects, H. H. KNIGHT (*New York Cornell Sta. Bul.* 410 (1922), pp. 491-496, pls. 8).—In connection with an investigation of insects affecting the fruit of the apple, noted on page 757, the author has also studied injuries due to other agencies, and brief accounts are given of mechanical injuries, lime-sulphur spray injury, sun scald, frost, hail, apple scab, and stippen.

Blister canker (*Iowa Sta. Rpt.* 1921, pp. 45, 46).—It is reported that cutting out cankered portions of apple trees and painting the wounds with a paint consisting of white lead and raw linseed oil to which was added corrosive sublimate has given 85 per cent control for the past seven years in the station orchard at Council Bluffs. It is also reported that blister canker is rather a secondary infection on trees which have been injured by winter, drought, overproduction, or other cause which lowers the vitality of the tree.

Dissemination of fire blight, H. A. GOSSARD and R. C. WALTON (*Ohio Sta. Bul.* 357 (1922), pp. 81-126, figs. 16).—The results are given of experiments

conducted through several years to determine the interrelations between some of the chief factors concerned in the dissemination of the fire blight organism, *Bacillus amylovorus*, particular attention being given to the rapid spread of blossom blight. The relation of bees and other insects to fire blight dissemination was studied at length.

It was found that the organism of fire blight may live for 72 hours or more in honey, but this appears to be about the limit. Fire blight developed in tender twigs that were inoculated with honey drawn from three different hives, and pollen removed from the baskets of bees caught entering the hives, when inoculated, caused the death of young twigs in several instances. The mouth parts of bees, caught when entering the hives after visiting flowers, when introduced into tender twigs apparently transferred the disease, but the organism was not recovered in cultures. The fire blight organism was found able to live in aphid honeydew for 7 days, or until the honeydew had become completely dried, and it was still viable three days longer when moisture was added. The organism was also found able to live in peach, plum, and cherry nectar for 5 days, and it is believed that while these trees are not subject to fire blight, organisms present in the nectar may be a source of contamination to apple and pear twigs.

Rain is said to be a most important carrier of infection over a tree after infection has once been established. Susceptibility to inoculation was found to cease in blossoms that had been pollinated for 144 hours, and there is apparently little probability of inoculation after 72 hours. In addition to bees, several other insects were observed to be carriers of fire blight, but negative results were obtained in attempts to produce early spring infection with ants. The authors also failed to isolate the blight organism in early spring from the bodies of aphids, aphid wax, and syrphid larvae taken from living blight cankers. There is claimed to be evidence for crediting blossom fire blight with traveling northward with the zone of inflorescence to a greater extent than is now accepted. The application of the electric violet ray to leaves and twigs to test its killing power on fire blight gave negative results.

Experiments for the control of *Armillaria mellea*, W. A. BIRMINGHAM and W. B. STOKES (*Fruit World Australasia*, 22 (1921), No. 10, pp. 364, 365).—Experimentation to control *A. mellea* on the roots of orange trees is described. It is advised that land be planted to grain or other field crops for several years previous to its employment as a citrus orchard. A tree once diseased should be completely eradicated as soon as discovered.

Fungus blights of tea in northeast India during the season 1920, S. C. BOSE (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 2, pp. 91-96).—Notes admittedly incomplete in detail, regarding diseases reported for different sections indicated during 1920, on tea leaves, stems, and roots, respectively, include leaf blister blight (*Exobasidium vexans*), copper blight (*Laestadia camelliae*), brown blight and die-back (*Colletotrichum camelliae* [*Glomerella cingulata*, *Gloeosporium* sp.]), gray blight (*Pestalozzia theae*), rim blight (*Alternaria* sp. and physiological causes), and black rot (*Hypochnus theae*); stem canker (*Nectria cinnabarina* and *Nectria* sp.), callosities (causes unknown), red rust (*Cephaleuros mycoidea* or *C. virescens*), and thread blight (a sterile mycelium); and root diseases connected with *Ustilina zonata*, *Rosellinia arcuata*, *Sphaerostilbe repens*, *Hymenochaete noxia*, and *Thyridaria tarda*.

A new disease associated with *Colletotrichum* sp. and with *T. tarda* in a specimen from Nowgong is under investigation.

Oytospora canker, a disease destructive to cottonwoods and poplars, J. G. BROWN (*Arizona Sta. Timely Hints for Farmers*, No. 138 (1922), pp. 4,

figs. 2).—A description is given of a serious disease of cottonwoods and poplars due to *C. chrysosperma*, which has appeared in the southwestern part of the United States. Differences in susceptibility to fungus attack are pointed out, and for control the planting of resistant varieties is recommended, as well as providing proper drainage and giving careful attention to pruning.

The development of *Dothidella ulmi*, C. KILLIAN (*Rev. Gén. Bot.*, 32 (1920), No. 384, pp. 534–551).—Material suitable for the demonstration of dimorphism as regards reproductive structures in fungi is said to be offered by *D. ulmi*, which is parasitic on elm leaves in portions mentioned of France.

The diseases and pests of the rubber tree, T. PETCH (*London: Macmillan & Co.*, 1921, pp. X+278, pls. 6, *figs. 38*).—In 1911 the diseases which were known to attack the rubber tree were described in *The Physiology and Diseases of Hevea brasiliensis* (E. S. R., 28, p. 246). The number of recorded diseases was comparatively small, but has been considerably extended during the intervening years, while the work of numerous investigators has added largely to the knowledge of both old and new diseases. A separate account, revised to date, has therefore been prepared of the diseases and pests only. As this book is intended primarily for the rubber planter, technical botanical details have been avoided as much as possible. Illustrations have been chosen with the idea of enabling the planter to identify the different diseases, and therefore represent typical stages. A brief summary of the diseases described has been added to each of the principal chapters for use in a rapid survey for purposes of identification.

A chapter has been included on the principal pests of *Hevea*, which up to this time, with the exception of *Termes gestroi*, have been considered of minor importance in comparison with fungus diseases. Other chapters are devoted to the subjects of general sanitation, root diseases, leaf diseases, Phytophthora diseases, stem diseases, nonparasitic diseases and abnormalities, prepared rubber, and miscellanea (including the effect of preservatives on renewing bark, lime-sulphur solution, Bordeaux mixture, and Woburn Bordeaux).

The control of sap stain, mold, and incipient decay in green wood, with special reference to vehicle stock, N. O. HOWARD (*U. S. Dept. Agr. Bul.* 1037 (1922), pp. 55, pls. 2, *figs. 26*).—The author describes chemical stains which are said to be produced by reactions brought about through the agency of oxidizing enzymes present in the wood, and fungus stains known to be caused by several species of fungi. For the control of sap stains, care in the selection of raw stock in order to obtain material free from fungus infections, expedition in the movement of raw stock from felling the logs to the process of manufacture, ample ventilation of the stock at all times, and kiln drying of timber, wherever possible, are recommended.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A geographical study of the kangaroo rats of California, J. GRINNELL (*Calif. Univ. Pubs. Zool.*, 24 (1922), No. 1, pp. 124, pls. 7, *figs. 24*).—Thirty-three species and subspecies are recognized as occurring within the boundaries of California.

The food and feeding habits of the little owl, W. E. COLLINGE (*Jour. Min. Agr.* [London], 28 (1922), Nos. 11, pp. 1022–1031; 12, pp. 1133–1140).—This report of studies extending over three years includes tables showing the monthly percentages of the principal food items of 194 adults and 18 nestlings of the little owl (*Carine noctua* Scop.). A tabulation is made of the great variety of animal food identified in the stomachs and pellets. The results obtained in

this investigation clearly show that the losses occasioned to game birds have been grossly exaggerated.

Entomology (*Iowa Sta. Rpt. 1921, pp. 40-43*).—In control work with the apple leafhopper on potatoes in a 20-acre field, excellent results were obtained from three applications of Bordeaux mixture in spite of a 10 weeks' drought. A brand of commercial dry Bordeaux mixture mixed with water was found to be as effective as the homemade, but this appears to have been due to the lack of rain, as it is readily washed from the foliage. Bordeaux mixture was found to have an insecticidal value, the nymphs dying in from one to nine days after feeding upon leaves sprayed with it and the youngest nymphs often dying within 24 hours. Hopperburn was artificially produced by the injection of emulsions made by crushing a large number of leafhoppers of the fourth and fifth stages in water. The presence of some toxic substance within the leafhopper was further demonstrated by placing the residue from the emulsion on leaf petioles and then pricking this in by means of a fine scalpel.

Studies of the working habits of bees show that a bee searching for nectar of a given species of honey plant pays no attention to flowers of any other kind upon a given trip, and it was found that a bee will remain faithful to its particular flower day after day. During any portion of the day when no nectar is available from this particular kind of flower, the bee seldom goes to the field at all, although nectar may be had from other kinds of flowers. Only in exceptional cases were nectar carriers found to change over, even temporarily, to the work of gathering pollen upon the cessation of the nectar flow for the remainder of the day. A bee carrying pollen from a plant such as corn, which produces no nectar, rarely was found to leave the hive after its particular kind of pollen ceased to be available for the day.

"Bees gathering pollen from corn and from the great ragweed frequently returned loaded within 5 minutes after leaving the hive, while bees gathering pollen from white clover seldom returned in less than 20 minutes. The most frequent interval spent in the hive between field trips was found to be 3 minutes, whether the bee was carrying nectar or pollen. A summary of results obtained during the past four years shows that the average annual honey production for the combless package colonies has been 80 lbs. as against 100 lbs. for wintered colonies . . . Careful tests showed that when feeding a sirup composed of two parts granulated sugar and one part water by weight, the amount of ripened stores resulting was approximately equal to the weight of the sugar alone, when the feed was given after brood rearing had ceased."

Fifty-first annual report of the Entomological Society of Ontario, 1920 (*Ent. Soc. Ontario Ann. Rpt., 51 (1920), pp. 92, figs. 6*).—The papers presented in this report (E. S. R., 45, p. 454) include the following: Reports on Insects of the Year, Division No. 3, Toronto District, by A. Cosens (pp. 12, 13), and Division No. 4, by F. J. A. Morris (pp. 13, 14); Notes on Leaf Bugs (Miridae) Attacking Fruit Trees in Ontario, by L. Caesar (pp. 14-16); The Manitoba Grasshopper Campaign of 1920, by A. V. Mitchener (pp. 16-19); Some Phases of the Present Locust Outbreak in Manitoba, by N. Criddle (pp. 19-23); The Influence of Locusts on the Ranges of British Columbia, by E. R. Buckell (pp. 23-29); The Invasion of Southern Alberta by Beet Webworms, by E. H. Strickland (pp. 29-31); The Present Status of the Hessian Fly in Western Ontario (pp. 32-34) and Insects of the Season 1920 (pp. 34, 35), both by H. F. Hudson; Insects of the Season in Ontario, by L. Caesar and W. A. Ross (pp. 35-42); Some of the Broader Aspects of Insect Control, by E. P. Felt (pp. 43-49); Further Data on *Phorbia brassicae*, by L. Caesar (pp. 50,

51); The Control of the Cabbage Root Maggot in British Columbia, by R. C. Treherne and M. H. Ruhman (pp. 51-53); Interrelations in Nature, by W. Lochhead (pp. 53-60); Conference on the European Corn Borer (pp. 60-62); Notes on the Control of the Rose Midge, by W. A. Ross (pp. 63-66); Some Mosquito Problems of British Columbia, by E. Hearle (pp. 66-70); Report on Injurious Insects in Quebec District for 1920, by G. Maheux (pp. 70-72); and The Entomological Record, 1920, by N. Criddle (pp. 72-74).

Grasshoppers, cutworms, and army worms and their control by poisoned bran mash, A. L. Ford (*S. Dak. Agr. Col. Ext. Circ.* 38 (1922), pp. 16, figs. 9).—This is a popular summary of information based upon investigations previously noted (*E. S. R.*, 46, p. 657).

The insect visitors of fruit blossoms and the pollination and the fertilization of fruit, C. H. HOOPER (*[Fed. Brit. Growers] Jour.*, 1 (1922), No. 4, pp. 93-98, figs. 12).—The author here summarizes the results of observations made upon the insect visitors of fruit blossoms and experiments in the pollination of hardy fruits.

Studies of insects affecting the fruit of the apple, with particular reference to the characteristics of the resulting scars, H. H. KNIGHT (*New York Cornell Sta. Bul.* 410 (1922), pp. 449-498, pls. 40).—This is a report of an extensive series of observations and photographs on the production and development of scars induced by the various insects attacking the apple, commenced during the season of 1914 and continuing during four growing seasons in orchards throughout Genesee County. In the course of this work extensive data were obtained on the scars and blemishes caused by all of the well-known injurious insects affecting the fruit of the apple, and detailed observations and photographs were made of the work of several species that are scarcely to be recognized from the scars they produce.

"New and little-known types of scars were studied, particularly those caused by the apple redbugs *Lygidea mendax* and *Heterocordylus malinus*. The scars caused by these bugs were found to develop differently according to the variety of apple affected and the time of puncture with reference to the growth of the fruit. Several species of lepidopterous larvae are known to injure the fruit of the apple, and comparative studies were made of 15 different species, and photographs were obtained showing the chief characteristics of their work and the resulting scars. In all, 30 species of insects, representing 5 orders, were found attacking the fruit of the apple in western New York, and comparative studies show that with sufficient observation and experience a large proportion of all the blemishes and scars found on apples at picking time may be correctly referred to the insects causing them. Comparative studies with an extensive series of photographs were made of the scars and blemishes caused by agencies other than insects, particularly by spray injury, mechanical injuries, apple scab, frost, and hailstones."

The insects studied and here reported upon include 9 species of Hemiptera, 15 of Lepidoptera, 3 of Coleoptera, 1 of Diptera, and 2 of Hymenoptera. The methods of study are briefly described, and the growth of fruit in relation to time of injury as a factor in the type of scar developed precedes the discussion of the nature of the injury caused by the different species. The account concludes with a discussion of Injuries to the Fruit of the Apple by Agencies other than Insects (pp. 491-496), noted on page 753. A list of literature giving one or two of the more important references to each insect discussed is appended.

The strawberry root weevil, with notes on other insects affecting strawberries, W. DOWNES (*Canada Dept. Agr. Pamphlet* 5, n. ser. (1922), pp. 16,

figs. 5).—This is a summary of information on *Otiorynchus ovatus* L. in British Columbia, including investigations conducted in the center of the strawberry-growing district of Gordon Head, Vancouver Island, B. C. Studies of this pest in British Columbia by Treherne have been noted (E. S. R., 46, p. 159). Other strawberry enemies briefly considered include the black vine weevil (*O. sulcatus* Fab.), the strawberry crown miner (*Aristotelia fragariae* Busck), the western 10-lined June beetle (*Polyphylla decemlineata* Say), and the strawberry crown moth.

The pests of the date palm in the Iraq, Y. RAMACHANDRA RAO (*Mesopotamia Dept. Agr. Mem. 6* (1921), pp. 21, pls. 6).—This is an account of the insect enemies of the date palm in this district of Mesopotamia, in which Protectorate the date is the most important economic product. The insect pests considered are *Batrachedra amydraula* Meyr., *Pseudophilus testaceus* Gah., *Oryctes elegans* Prell, *Paratetranychus* sp., the date fulgorid, three scale insects of which *Parlatoria blanchardi* Targ. is the most widely distributed, *Schistocerca peregrina*, undetermined termites, and *Ephestia cautella*. The microlepidopteran *B. amydraula*, which bores into the young date fruit causing them to dry up or turn red, is the most important. A Supplementary Note on the Pests of the Date Palm in Iraq, by A. Dutt, is appended (pp. 13-21).

Progress in insect control: A new preparation of aceto-arsenite of copper (Paris green), K. ESCHERICH (*Deut. Landw. Presse*, 48 (1921), No. 15, pp. 104, 105; *abs. in Internatl. Inst. Agr.* [Rome], *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 6, pp. 788, 789). This is a brief account of a tablet preparation of Paris green. Each tablet is divided by grooves into five parts, one of which is sufficient to make 20 liters of spray mixture. Since the neutralizing agent is incorporated in the tablets, the necessity for adding lime and the loss of time in weighing is avoided.

Cryptothrips laureli, a new thrips from Florida (Thysanop.), A. C. MASON (*Ent. News*, 33 (1922), No. 7, pp. 193-199, pl. 1).—The author's investigations have shown that the thrips that occurs in the central part of Florida on the native bay trees of the genus *Tamala* (Persea), although resembling and previously supposed to be the camphor thrips, represents a new species which is here described as *C. laureli*. While this new species will live on camphor, it is thought that it will not establish itself permanently there. Camphor trees growing close to bay trees infested with thrips were uninjured. Brief notes are given on its life history, habits, and natural enemies.

The bean leafhopper and hopperburn, with methods of control, A. H. BEYER (*Florida Sta. Bul. 164* (1922), pp. 88, *figs. 16*).—This is an account of the apple leafhopper (*Empoasca mali* LeB.), the nymphs and adults of which attack the bean in Florida. They feed on the mid-vein and its branches, and seem especially fond of the upper portion or tip of the leaf. The sucking of sap from these leaf veins seriously affects the life of the plant, and results at first in its turning yellow at the tip of the leaf. As this injury gradually spreads, the leaf turns brown, curls upward at its tip and margin, and finally withers. If the infestation is slight, the basal area of the leaf may remain green.

"Spraying with Bordeaux mixture, 4-4-50 formula, to which should be added 0.5 pint of nicotin sulphate to 50 gal. of the Bordeaux, applied with a special spraying apparatus at a pressure of 200 lbs., gives good results. From four to six applications are required to control the leafhopper and prevent hopperburn, depending upon the abundance of the infestation, the season of the year, and the condition of the weather."

A new spraying device, which the author has designed and here describes, contains three wide-angle mist spray nozzles connected to a common hose

attached to a pressure pump and sprayer tank. The nozzles are inclosed within a canvas-covered cylinder 31 in. in length and 24 in. in diameter, with a notch-like 8-in. opening to pass over the row. Experiments have shown this new device to prevent the escape of insects when spray is applied to the plants, which results in their being killed by direct contact with the spray or by suffocation from the fumes of the combined nicotine and whale-oil soap. It also permits a thorough application of spray to the smallest plants since two of the nozzles are adjacent to the ground. This device can be operated successfully as fast as a horse usually walks, an acre having been sprayed in one hour.

Notes on the etiology and specificity of the potato tipburn produced by *Empoasca mali* LeB., J. R. EYER (*Phytopathology*, 12 (1922), No. 4, pp. 181-184, pl. 1, fig. 1).—Investigations at the Pennsylvania Experiment Station, here reported, have led to the following conclusions:

"A tipburn of the potato plant is produced by the extract made from macerated leafhoppers of the species *E. mali* and is transmissible by direct inoculation. The active principle of this extract is most virulent in the nymphal stage of the leafhopper. The 'specific' of tipburn is present in diseased leaf tissue after infection by the leafhopper and may be transmitted to healthy plants by reinoculation. This substance is specific, and the disease has not been simulated by inoculation with extracts from or by the direct feeding of insects other than *E. mali*, or by mechanical injury. Sunlight is an important factor in the progress of tipburn after its inception, but the absence of sunlight does not prevent the disease."

Spraying for hopperburn, J. E. KORULA (*Michigan Sta. Circ.* 48 (1922), pp. 4, figs. 2).—A brief account of this affection of the potato, attributed to leafhoppers (*Empoasca mali* LeB.), with recommendations for its control.

Aphids attacking stone fruits in Idaho and methods for their control, R. H. SMITH (*Idaho Sta. Circ.* 26 (1922), pp. 3-11, figs. 9).—This paper deals with two aphids of particular importance to the peach, namely, the green peach aphid and the black peach aphid; four of particular importance to plums and prunes, namely, the leaf-curl plum aphid (*Anuraphis hebechrysi* Kalt.), the green peach aphid, the plum thistle aphid (*A. cardui* L.), and the hop aphid; and the cherry aphid, which attacks cherry trees. Brief accounts are given of these pests and means for their control.

The black scale problem, H. COMPERE (*Calif. Cult.*, 59 (1922), No. 2, pp. 29, 30, figs. 2).—This is a discussion of the black scale situation in California and of the hymenopterous parasite *Aphyus lounsburyi*, which is expected to play an important part in its control.

Natural control of scale insects in Hawaii, D. T. FULLAWAY (*Hawaii. Ent. Soc. Proc.*, 4 (1920), No. 2, pp. 237-246).—This paper includes a list of scale insects occurring in Hawaii, with their natural enemies, both parasitic and predatory.

In defense of Scalecide, B. G. PRATT (*Better Fruit*, 16 (1922), No. 12, p. 20).—The fact that in the experiments in Montana by J. R. Parker, previously noted (*E. S. R.*, 46, p. 156), Scalecide failed to kill more than 75 per cent of the leaf rollers, the author believes to be entirely due to the fact that the spray gun was used, since he has found it to give satisfactory results when applied by a cluster of fine nozzles.

Effects of miscible oil sprays, C. C. VINCENT (*Better Fruit*, 16 (1922), No. 11, pp. 9, 27, 28, fig. 1).—In experiments conducted by the Idaho Experiment Station against the San José scale in the Lewiston Valley during a period of three years it was found that miscible oil sprays gave slightly better results than did lime sulphur, the efficiency ranging from 94 to 99 per cent. The ap-

plications were made in early spring just as the buds were beginning to swell.

On *Laspeyresia molesta* Busck (the Oriental peach moth) abroad and in Italy, G. PAOLI (*Agr. Colon. [Italy]*, 15 (1921), No. 12, pp. 572-576, pl. 1; *abs. in Rev. Appl. Ent.*, 10 (1922), Ser. A, No. 3, p. 122).—This is a summary of information on *L. molesta*, which occurs commonly in all of Liguria, where it has been observed only during the past six or seven years.

Biology of the lotus borer (*Pyrausta penitalis* Grt.), G. G. AINSLIE and W. B. CARTWRIGHT (*U. S. Dept. Agr. Bul.* 1076 (1922), pp. 14, pls. 4).—This is a report of studies of *P. penitalis* conducted by the authors at Kimberlin Heights, near Knoxville, Tenn. A previous paper by the authors on the smartweed borer (*P. ainsliei*), previously confused with this species, has been noted (*E. S. R.*, 45, p. 154).

The species apparently passes the winter in the larval stage. "The overwintering larvae pupate, and the moths emerge and oviposit about mid-June. The resulting larvae feed on the leaves, and when fairly grown, about July 1, seek the flowers and enter the young pods, feeding upon them to some extent and pupating within them. The moths of this first generation emerge from July 7 to 28. Eggs are at once produced by these moths and constitute the first stage of the second generation. The eggs soon hatch, and the oldest of the larvae produced are approximately half grown by July 19; but moths of the first generation continue to oviposit until about August 5, so that second generation larvae are hatching continuously from July 10 to August 8. A collection of these larvae made July 28 pupated August 3 to 18, and moths emerged August 12 to 27. These larvae of the second generation feed on the leaves and pupate in the upper ends of the leaf petioles.

"The moths of the second generation give rise to the third generation eggs and larvae, which survive the winter and constitute the spring generation. It seems possible that some of the smaller larvae of the second generation seek hibernation quarters instead of completing their growth the same fall. In this case there would be only two generations annually, but it seems probable that there are three generations as a rule. Their behavior from the time the larvae seek winter quarters in the fall until the young larvae of the first generation appear on the leaves in June is unknown, and the outline here given for that period is hypothetical."

The only natural food plants which have so far been reliably ascertained are the yellow lotus (*Nelumbo lutea*) and the Indian lotus (*N. nucifera*), an introduced species. In the laboratory partly grown larvae, taken on lotus, fed readily and completed their growth on leaves of smartweed, buckwheat, and dock (*Rumex crispus*).

Its natural enemies include four tachinids and several hymenopterous parasites, namely, *Bracon xanthostigma* Cress.; *Apanteles harti* Vier., which was found by the authors to be the most common one at Kimberlin Heights; a yellowish brown species of *Microbracon*, which was found by the authors to be nearly as common as *A. harti*; *Chalcids ovata* Say, reared from the pupae by the authors in three instances; and *Trichogramma minutum* Ril., reared from eggs.

A list is given of 18 references to the literature.

An aerial survey of mosquito breeding places, E. HEARLE (*Agr. Gaz. Canada*, 9 (1922), No. 3, pp. 191-195, figs. 2).—This is a discussion of an investigation of mosquito breeding areas in the Lower Fraser Valley in British Columbia, conducted in 1921 by the Dominion Entomological Branch, with which the Canadian Air Board cooperated.

The Hessian fly, R. H. PETTIT (*Michigan Sta. Circ.* 49 (1922), pp. 8, fig. 1).—A brief account of the life history and work with the Hessian fly is followed by a discussion of its control, in connection with which a table is given of the computed fly-free dates for the seeding of winter wheat in each county and at varying latitudes in Michigan.

A new species of fruit fly parasite from Java (Hymenoptera), D. T. FULLAWAY (*Hawaii. Ent. Soc. Proc.*, 4 (1920), No. 2, pp. 260, 261).—Under the name *Biosteres javanus*, the author describes a new hymenopterous parasite reared at Buitenzorg, Java, from pupae of *Dacus ferrugineus* in fruits of *Capiscum*.

The apple root borer, J. B. HARRIS (*Jour. Dept. Agr. So. Aust.*, 25 (1922), No. 8, pp. 706, 707).—This is a brief account of *Leptops rhizophagus*, a curculionid beetle, which is responsible for considerable damage to apple trees in small portions of the district of Stanley and Wirrabara Forest.

Observations on *Typocerus sinuatus* Newm. as a forage plant pest, J. S. WADE (*Bul. Brooklyn Ent. Soc.*, 17 (1922), No. 1, pp. 26-29, figs. 3).—The author reports upon observations in southern Kansas and northern Oklahoma of injury by this cerambycid to the root system of *Andropogon scoparius* Michx., a valuable forage grass. The injury is caused by its eating out the crown of the plants so that the stems break off just below the surface of the ground. Brief descriptions of the larva, pupa, and adult and a short account of its life history are included.

Fighting bark beetles in balsam; Ravages of spruce budworm in valuable forest areas, F. C. CRAIGHEAD (*Canad. Forestry Mag.*, 18 (1922), No. 6, pp. 820, 821, figs. 3).—This is a discussion of the spruce budworm situation in eastern Canada, with a brief description of a bark beetle control operation conducted by a lumber company.

The alfalfa weevil (*Nevada Sta. Rpt.* 1921, pp. 16-20) --Investigations conducted during the year have shown that the alfalfa weevil, which was first discovered just outside the city limits to the north of Reno, in June, 1920, is now present in all alfalfa fields lying north of the Truckee River from a point about 2 miles northwest of Reno to a point about 5 miles to the east of the city. The parasite found effective in Utah was introduced and is thought to have become established.

A weevil enemy of sisal, H. MORSTATT (*Tropenpflanzer*, 24 (1921), No. 3-4, pp. 33-37, figs. 6).—This is an account of injury caused by *Scyphophorus acupunctatus* Gyll. to sisal in East Africa, where it was first observed attacking Agave in 1914.

The weevil fauna of South India with special reference to species of economic importance, T. V. RAMAKRISHNA AYYAR (*Agr. Research Inst., Pusa, Bul.* 125 (1922), pp. 21, pls. 20).—This report on the weevil fauna of South India includes a large number of illustrations, and several colored plates illustrating the several stages and the nature of their injury.

The Tahiti coconut weevil, *Calandra taitensis* Guer., in Hawaii, O. H. SWEZEY (*Hawaii. Ent. Soc. Proc.*, 4 (1920), No. 2, pp. 333-335).—The author records the discovery of this weevil in Hawaii in August, 1919, at which time it was found to be widely distributed on the leeward coast of that island.

Mound-building ants in forest plantations, H. B. PIERSON (*Jour. Forestry*, 20 (1922), No. 4, pp. 325-336).—This is a report of observations commenced in 1919 in the Harvard Forest at Petersham, Mass., of the loss caused by *Formica exsectoides*.

Where the mounds occur the trees soon begin to die in an ever-widening circle around the nests, the areas of dying trees being found only around the ant

mounds. Close inspection shows a deep constriction or lesion on the main stem near the base of the trees, appearing superficially as though rodents had been feeding upon the trunks except that the bark is in most cases intact. The constriction extends from about 3 in. above the ground to a distance of about 4 in. in length, entirely encircling the stem. The observations indicate that the ants kill the trees in an effort to keep their nests continually in the sunlight. White pine above 6 ft. in height is said to be rarely killed. There seems to be no limit to the species of trees killed or severely injured, the author having observed *Pinus strobus*, *P. sylvestris*, *Juniperus communis*, *J. virginiana*, *Populus tremuloides*, *Hicoria ovata*, *Betula populifolia*, *Quercus ilicifolia*, *Pyrus malus*, and *Rhus hirta*. The paper includes a discussion of the life history and habits of the ant, the manner in which the trees are killed, and control measures.

The western wheat-stem sawfly and its control, N. CRIDDLE (*Canada Dept. Agr. Pamphlet 6, n. ser.* (1922), pp. 8, figs. 7).—This is a brief summary of information of *Cephus cinctus* Nort., with methods of control. Four hymenopterous parasites of this pest have been found in Manitoba, namely, *Microbracon cephi* Gah., *Pleurotropis utahensis* Cwfd., *Eupelmus atymni* Fren., and a *Eurytonia* species. All of these species are present in considerable numbers, attacking the sawfly in grasses, and due to their combined efforts practically half of the sawfly larvae were destroyed in the grasses in 1921. Studies of this pest by Ainslie have been noted (E. S. R., 43, p. 259).

On the larval development of *Dacnusa areolaris* Nees (Braconidae), a parasite of Phytomyzinae (Diptera), with a note on certain chalcid parasites of phytomyzids, M. D. HAVILAND (*Parasitology*, 14 (1922), No. 2, pp. 167–173, figs. 5).—This is an account of a parasite of the leaf-miner *Phytomyza angelicae* Zett., which infests wild Angelica (*A. campestris*) in the neighborhood of Cambridge, England.

The egg of this braconid parasite is deposited within the body of the host, within which its development takes place. "A membrane of trophic cells is formed, within which the embryonic and first larval stages are passed. The further growth and development of the parasite are delayed until after metamorphosis of the host, probably to insure sufficient food in the later stages. The length of the larval and pupal life of the parasite is intimately correlated with the puparial period of the host. It is suggested that this is an adaptation to insure that an adequate supply of host larvae shall be hatched by the time that the parasites are ready to oviposit. Certain Chalcididae of the genera *Eulophus* and *Chrysocharis* are ectoparasites of *P. angelicae*, and a summary of observations on their life cycle is given."

Biological observations on *Habrobracon johannseni* Vier., B. TROUVELOT (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 35, pp. 1022–1024).—This is a report of observations of a braconid parasite of the potato-tuber worm recently introduced from California for combating the pest in France. They relate particularly to the habit of the adult parasite of stinging its caterpillar host after it has spun a cocoon and of feeding upon the fluids of the caterpillar through the oviposition hole.

Biological observations on *Habrobracon* spp., P. GÉNIEYS (*Compt. Rend. Soc. Biol. [Paris]*, 86 (1922), No. 15, pp. 829–831).—This note presents the results of the author's observations on the manner of feeding of (1) *H. brevicornis*, a parasite of the European corn borer and of other hosts, including the potato-tuber worm, and of (2) *H. johannseni*, reared either from *Phthorimaea* out of its cocoon or another host.

Spider mites affecting orchard and garden fruits, R. H. SMITH (*Idaho Sta. Circ.* 25 (1922), pp. 8, figs. 3).—The author here gives a brief summary of

information on three species of importance that occur in Idaho, namely, the two-spotted spider mite or red spider (*Tetranychus telarius* L.), the clover mite, and the European red mite (*Paratetranychus pilosus* C. & F.)

FOODS—HUMAN NUTRITION.

Digestibility of raw rice, arrowroot, canna, cassava, taro, tree-fern, and potato starches. C. F. LANGWORTHY and H. J. DEVELL, JR. (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 251-261).—The study of the digestibility of raw starches (E. S. R., 43, p. 365) has been extended to rice starch and several root and tuber starches, the method followed being exactly the same as in the previously reported studies. The various starches used, and their estimated digestibility, were as follows:

Raw rice starch 100, true arrowroot (*Maranta arundinacea*) 95.7, commercial arrowroot (*Zamia floridana*) 82.5, canna (*Canna edulis*) 53.3, cassava (*Manihot utilissima*) 98.8, taro root (*Caladium colocasia* or *Colocasia esculenta*) 98.8, and tree fern (*Cibotium menziesii*) 93.4 per cent. The experiment with potato starch was repeated, using a smaller amount. The average of two determinations was 97.1 per cent, showing that the smaller the quantity of raw potato starch the higher was the coefficient of digestibility.

In discussing these results it is noted that there is apparently a direct relationship between the size of the starch granule and its digestibility. "Whether this relationship is accidental or not has not been determined. One might readily suppose that the larger starch granule contained a thicker cellulose covering and consequently one more impervious to the digestive ferments than the smaller granule. The factor of surface area might also come into consideration, since the larger the granule the proportionately smaller surface area for being attacked."

The utilization of calcium and phosphorus of vegetables by man, N. R. BLEATHERWICK and M. L. LONG (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 125-131). To determine the utilization of calcium and phosphorus of vegetables, two subjects, healthy young women, subsisted for four days on a diet so planned as to approximate as closely as possible the maintenance requirements of nitrogen, phosphorus, and calcium according to Sherman (E. S. R., 42, pp. 459, 554; 41, p. 563). This period was followed by one of seven days in which the diet of one of the subjects was altered by substituting 0.5 gm. of phosphorus from vegetable sources for an equivalent amount obtained from milk, beef, and eggs, and that of the second subject by the addition of 0.5 gm. of vegetable phosphorus to the diet of the first period. The balance of nitrogen, phosphorus, and calcium was determined for the entire period. Tables are given of the kinds and amounts of food consumed, with the daily intake of calories, protein, calcium, and phosphorus and the output of calcium, phosphorus, and nitrogen.

The urine during the vegetable period was in both subjects of lower H-ion concentration than in the preliminary period. In the first period the balance of all three elements was negative for the first subject, and that of phosphorus and nitrogen slightly negative and of calcium decidedly negative for the second subject. In the second period, the first subject had a negative nitrogen and a positive calcium and phosphorus balance, and the second subject a positive balance of all three elements.

The data are thought to indicate that calcium and phosphorus derived from vegetables are capable of meeting the vegetable needs of man.

Dehydrated pumpkin flour, A. W. CHRISTIE (*Amer. Food Jour.*, 17 (1922), No. 7, pp. 7, 8, figs. 3).—An account is given of an attempt which has been made to dehydrate pumpkin for marketing in the form of a flour.

Wheat grown in Alaska makes good pastry flour (*Amer. Food Jour.*, 17 (1922), No. 4, p. 9).—In addition to other data regarding flour produced from wheat grown in the Tanana Valley, Alaska, a brief account is given of results of baking tests carried on in cooperation with the Alaska Experiment Stations by the Office of Home Economics, States Relations Service.

"These samples, while less satisfactory for yeast-risen breads than some of the flours produced in the United States, proved to be excellent for making baking-powder biscuits, cake, and pastry products, when judged according to volume, texture, flavor, and general appearance. The color of the crumb in these bakings was creamy yellow, but not unattractive."

The chemical composition of millet flour, G. QUAGLIABIELLO (*R. Accad. Lincei, Comitato Sci. Aliment.* [Rome] Pub., No. 11, (1921), pp. 19).—Analyses are reported of flour obtained from millet (*Panicum miliaceum*), grown in the Province of Lecce, Italy. The average composition of the millet flour was as follows: Moisture 13 per cent, nitrogen 8.19, fat 4.09, starch and sugars 67.57, cellulose 5.62, and ash 1.78 per cent.

Compared with analyses of other flours the millet flour is distinguished by its richness in cellulose and fat and its low content of protein.

Foods and drugs, J. M. BARTLETT (*Maine Sta. Off. Insp.* 103 (1922), pp. 24).—This reports the results of examinations made under the State pure food and drug law of a number of samples, including nonalcoholic beverages, ice cream, opened clams, lemon extract, vanilla extract, artificial or imitation vanilla, vinegar, and miscellaneous food samples, and drug products.

[Experiments in electrical cooking] (*Hotel Mo.*, 30 (1922), No. 352, pp. 48, 49).—Some information is given regarding the successful use of electrical ovens in a hotel as well as data regarding kitchen equipment, refrigeration, ventilation, and other topics.

Camp cooking fires, L. PLUMLEY (*Amer. Cookery*, 27 (1922), No. 2, pp. 108, 109, 140, 142).—A discussion of camp cookery.

Housekeeping in Holland (*Table and Housekeepers' Jour.*, 71 (1922), No. 1823, pp. 64, 65).—This descriptive article contains considerable information regarding food supply and related topics.

Tropical messes, J. B. BARRY (*Amer. Cookery*, 27 (1922), No. 2, pp. 95-99, figs. 2).—In this article, descriptive of the experience of a group of men in the educational service of the Philippines, much information is given regarding housekeeping under local conditions, food preparation, household supplies, and similar topics.

Food control (*Hotel Mo.*, 30 (1922), No. 352, pp. 66, 68, 70).—A digest of a paper presented at the Hotel and Restaurant Show in Chicago, outlining the author's system of storeroom management, accounting of supplies, and similar information.

Applied dietetics in outpatient departments, M. LADD (*Amer. Jour. Diseases Children*, 24 (1922), No. 3, pp. 211-217).—This paper, read before the American Pediatric Society, in Washington, D. C., May 1, 1922, discusses the organization of food clinics as adjuncts to medical outpatient departments of children's hospitals.

"Clean food" campaign is being launched (*Amer. Food Jour.*, 17 (1922), No. 7, pp. 13, 14).—The aims and objects of this article, descriptive of a movement being carried on by means of education and publicity work in New York City, are to bring about the more careful handling of food products. Information about the scope and extent of the work is included.

Recent applications of the principles of nutrition, H. VIOLLE and T. C. MERRILL (*Amer. Jour. Pub. Health*, 12 (1922), No. 7, pp. 568-574, figs. 2).—Essentially a description of Pirquet's new system of nutrition.

The minimum nitrogen expenditure of man and the biological value of various proteins for human nutrition. C. J. MARTIN and R. ROBISON (*Biochem. Jour.*, 16 (1922), No. 3, pp. 407-447, figs. 8).—In an extended series of experiments in which the authors served as subjects, a study was made of the minimum nitrogen expenditure on a carbohydrate-fat diet and of the biological value of wheat and milk proteins, calculated from Thomas's definition of this value as $\frac{\text{body nitrogen spared}}{\text{food nitrogen absorbed}}$.

In reporting the investigation a critical survey of the literature on the subject of the minimum protein requirements of the body is given, together with a discussion of the factors which must be considered if valid results are to be obtained in such determinations. For this and the detailed presentation of the results obtained in the present investigation the paper should be consulted in the original. The general conclusions drawn are as follows:

The minimum nitrogen expenditure by the urine was somewhat less than 0.038 and 0.035 gm. per kilogram for the two subjects, respectively. On taking a diet of carbohydrate and fat of adequate calorie value the nitrogen excreted in the urine falls in a regular manner, approaching a minimum in from five to seven days, and on resuming an ordinary mixed diet the nitrogen excreted rises in the same manner. The mean biological value of the nitrogen contained in whole wheat, as determined by six experiments on each of the two subjects, was 35 and 31 per cent, while the mean biological value of the nitrogen of cow's milk, as determined by three experiments upon one subject, was 51 per cent. It is considered that biological values arrived at from experiments of comparatively short duration have a limited significance, and that the application of Thomas's method of determining the biological values is justified in the case of bread, doubtful with milk, and impossible with gelatin.

Studies in creatin and creatinin metabolism.—IV, On the question of the occurrence of creatinin and creatin in blood, J. A. BENRE and S. R. BENEDICT (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 11-33).—The authors discuss the question of the existence of creatinin in the blood and report a study of this question along several different lines, including the application of certain creatinin reactions to both blood filtrates and pure creatinin solutions and to creatinin added to the blood; a comparison of the relative behavior of true creatinin and the blood creatinin, both before and after conversion of possible creatin into creatinin; and attempts to remove true creatinin from pure solutions or from blood filtrates. The results of these studies have led to the conclusion that creatinin does not exist in the blood in detectable quantities, and that the so-called creatinin as obtained by the various methods employed for determining creatinin represents another chromogenic substance of unknown nature. Tests for the presence of creatin, such as the method of Benedict, are considered to furnish satisfactory evidence that creatin may occur in the blood in very appreciable amounts, and that the blood creatin is a waste product possibly eliminated in the urine as creatinin or as urea.

Studies on uric acid, I, II. G. W. PUCHER (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 317-334).—Two papers are presented.

I. *Examination of the variables in the Folin and Wu uric acid method* (pp. 317-327).—This paper reports a study of the limits of accuracy of the Folin-Wu method of determining uric acid (*E. S. R.*, 41, p. 13). The data presented are summarized as follows:

"Within the accuracy of the colorimeter (2 to 3 per cent) the readings are proportional to the amount of uric acid present without applying any corrections. Uric acid must be precipitated in neutral solution by silver lactate and only under these conditions are consistent quantitative results obtained. The

precipitation of uric acid is very sensitive to mineral acid, but practically unaffected by lactic acid. Temperatures below 26° C. have no effect on the solubility of silver urate. Recovery by Folin and Wu's technique is consistently about 75 per cent. The loss must be due to mechanical retention or absorption by the precipitated proteins. By using trichloroacetic acid as the protein precipitant only a 50 per cent recovery of uric acid could be obtained."

II. *A modification of the Folin and Wu uric acid method* (pp. 329-334).—To avoid the loss of uric acid occurring during the coagulation and precipitation of proteins as described in the above paper, the author recommends heating the solution before filtration. It has also been found practicable to combine three of the Folin reagents into one solution, thus simplifying the technique. The solutions combined are the sodium sulphite, sodium cyanid, and sodium carbonate. The modified method is presented in detail.

Salivary secretion in infants, C. NICORY (*Biochem. Jour.*, 16 (1922), 3, pp. 387-389).—A brief report is given of an examination of the ptyalin of the saliva of 80 infants of different ages from a few hours after birth to one year.

The saliva in all cases contained ptyalin, the amount increasing gradually up to one year, when the composition of the saliva became identical with that of the adult. The quantity of ptyalin present also varied with the general condition of the child, being greater in strong than in weak children. In view of these results and the observation that many of the infants were receiving starchy food and suffering no digestive trouble, it is assumed that diastase must be present in the pancreatic secretion of infants.

Food, health, and growth: A discussion of the nutrition of children, L. E. HOLT (*New York: Macmillan Co.*, 1922, pp. X+273, figs. 24).—This volume consists of five lectures which were given at the Medical School of Stanford University in December, 1921, on the nutrition of children. The topics of the several lectures are as follows: Nutrition in relation to growth, to mental progress, and to resistance to disease; the food requirements of children during the entire period of growth; the conditions upon which are based the requirements for protein, fat, carbohydrate, and mineral salts and the percentage of the different food constituents in the diet of children; vitamins; and practical means by which the nutrition of children may be improved.

The food requirements of children.—III, IV, L. E. HOLT and H. L. FALES (*Amer. Jour. Diseases Children*, 23 (1922), No. 6, pp. 471-480, figs. 2; 24 (1922), No. 1, pp. 44-55, figs. 4).—These two papers continue the discussion of the food requirements of children previously noted (E. S. R., 46, p. 756).

In the first, the possible functions of fat as a purveyor of vitamin A, as an essential factor in mineral metabolism, particularly of calcium, and in protein metabolism, as a regulator of normal conditions in the intestine, and as an important source of energy are described, with references to the literature. Estimates of the amount of fat which should be taken by infants and older children are made on the basis of the composition of human milk and of the fat intake of the 100 children observed in the previous study.

The estimated fat intake of infants is given as 4 gm. per kilogram daily for nursing infants, and 3.5 gm. for infants taking modifications of cow's milk. The fat intake of the older children averaged over 3 gm. per kilogram per day for children under 6 years of age, and about 3 gm. for the rest of the growth period. On the basis of these figures and the evidence that fat is an important and necessary component of the diet, it is recommended that the diet of the child should contain as much as 4 gm. of fat per kilogram daily at 1 year, that this amount should be reduced to about 3 gm. per kilogram at 6 years, and that this value should be maintained throughout the remainder of the growth period.

In the second paper an examination has been made of available data on the carbohydrate consumption of children, the chief source of data as before consisting of observations of the actual carbohydrate intake of 100 healthy children from 1 to 18 years of age. Charts are given showing the values in grams of the total carbohydrate taken daily by these children, and the corresponding values in grams per kilogram of body weight. Tabulations are also given of the average intake, according to age, of total carbohydrate, of the calculated proportions of starch and sugar at different ages, and of the percentage of the total carbohydrate taken as different sugars.

The average carbohydrate intake of all of the subjects regardless of age was about 10 gm. per kilogram of body weight. The total intake showed a tendency to increase with fair regularity with age, and the intake per kilogram of body weight to decrease. While the proportion of sugar ranged from 27 to 82 per cent of the total carbohydrate, more than two-thirds of the values were between 40 and 60 per cent, the average of all cases being 51 per cent. The sucrose intake showed a steady increase up to the eleventh year and then a marked increase during adolescence. A large proportion of the sugar was supplied by fruits.

In discussing the optimum requirement of carbohydrate, attention is called to the disadvantages resulting from too high a proportion of carbohydrate, such as abnormal deposition of fat, digestive disturbances, and the inevitable reduction of fat and protein. In this connection it is emphasized that too great a reliance upon vegetable proteins in place of animal results in excessive carbohydrate intake. It is thought that the carbohydrate requirement can best be estimated by subtracting from the total caloric need the calories supplied by the needed amounts of fat and protein as recommended in the previous studies. This would amount to allowing about 12 gm. of carbohydrate per kilogram at 1 year, decreasing to about 9 and 10 gm. at 6 years, and maintaining this value throughout the remainder of the growth period. An increase in the total caloric need on account of increased activity may be supplied by carbohydrate alone.

The modification of cow's milk in infant feeding. E. PRITCHARD (*Lancet* [London], 1922, 1, No. 17, pp. 838-840).—Of interest in this discussion of modifications of cow's milk for infant feeding is the suggestion of the use of a bone and vegetable broth to supplement the usual ingredients of modified milk with a view to supplying other needed materials, such as salts, extractives, vitamins, lecithin, and cholesterol.

The broth is prepared as follows: "Take 1 lb. of bones and chop them up well so as to open up the marrow cavity, add one tablespoonful of vinegar and 1.5 pints of water, allow them to simmer for about eight hours, and then add a handful of mixed vegetables such as cabbage, Brussels sprouts, spinach, roots, lentils, etc., with a few sprigs of Irish moss and allow to simmer for one hour longer. Then strain and allow to set into a jelly."

The formula in which this broth is used is milk of average quality 10 oz., 33 per cent cream 1 oz., sugar (lactose at first but later lactose, maltose, and sucrose mixed) 1 oz., broth 4 oz., and water to make 1 pint. It is considered advisable to give orange juice in addition.

Further contributions to the knowledge of organic foodstuffs with specific action, VII—X. E. ABDERHALDEN (*Pflüger's Arch. Physiol.*, 191 (1921), pp. 258-301, figs. 18; 192 (1921), No. 4-6, pp. 163-182, figs. 25).—These four papers continue the series previously noted (E. S. R., 46, p. 470).

In the first paper (No. VII), by the senior author and E. Wertheimer, the results are reported of a study of the effect of different substances on the gaseous metabolism of various tissues, this study being undertaken with a view

to determining the nature of the active constituent of yeast and bran. Increased metabolism was obtained with glutamin, glutaminc acid, pyrrolidine-carboxylic acid, tryptophan, rape oil, cod liver oil, various organic acids, hexose phosphate, glycerophosphates, arsenites, and various antiscorbutic extracts. Yeast extract was found to accelerate plant respiration.

In the experiments reported in the second paper (No. VIII), guinea pigs were used as the experimental animal. When fed on scorbutic diets these animals showed a lowered gaseous metabolism which was raised by yeast administration. Experiments were also conducted to determine the effect of cystin and of peptone from feather, hair, and guinea-pig skin hydrolysis on the growth of hair. Negative results were obtained in all cases.

In the third paper (No. IX), it is noted that pigeons which are kept without food for a number of days and then are given yeast pellets for a day or two before being put on a polished rice ration take their food better than when they are given polished rice after a starvation period without the preliminary yeast feeding. It is reported that in pigeons suffering from alimentary dystrophy (deficiency disease) there is a decided decrease in the number of red blood cells, and that the hemoglobin content of the blood sometimes runs parallel with this and sometimes shows higher values.

The fourth paper (No. X), by the senior author and E. Wertheimer, is essentially an amplification of papers III and VIII.

Vital factors of foods: Vitamins and nutrition, C. ELLIS and A. L. MACLEOD (*New York: D. Van Nostrand Co., 1922, pp. XVII+391, figs. 22*).—This volume "aims to furnish all essential facts regarding vitamins and to bring together the literature on the subject, thus to supply not only a textbook but also a reference volume of a thoroughly comprehensive nature on these special but highly important phases of the nutrition problem."

Vitamin problems, A. HARDEN (*Nature [London], 110 (1922), No. 2748, pp. 14-16*).—A brief and concise summary of present knowledge of vitamins.

Vitamins in canned foods, E. F. KOHMAN (*Natl. Canners Assoc., Research Lab. Bul. 19-L (1922), pp. 92*).—For the information of canners a critical survey has been made of the literature on the effect of heat upon vitamins. The data thus obtained are tabulated with literature references. Preceding these tables is a general discussion of the nature of vitamins, together with a summary of the principal conclusions.

On the basis of the evidence reviewed, canned foods are considered to be practically as rich in vitamins A and B as the corresponding raw products. In acid products the destruction of vitamin C in canning is negligible, while in less acid foods such as animal and most vegetable products a considerable destruction of vitamin C takes place. On account of the absence of air in processing, there is thought to be less destruction of vitamin C in canning than in ordinary cooking.

Fish-liver oils and other highly potent sources of vitamin A, S. S. ZILVA and J. C. DRUMMOND (*Lancet [London], 1922, I, No. 25, p. 1243*).—This paper supplements one previously noted on the vitamin A content of fish-liver oils (E. S. R., 46, p. 567). Examination of numerous samples of cod liver oil prepared in the usual way by subjecting the livers to direct steam or by steaming them in jacketed pans has shown that, while the direct steam process is slightly more destructive than the steam-jacket method, the destruction of vitamin A by either process is of such a low order as to be negligible, as is also the further destruction in the process of clarification.

The potency of cod roe as a source of vitamin A is shown by the fact that daily doses of from 0.025 to 0.05 gm. proved sufficient to induce growth in rats

on a vitamin A free diet. It is also reported that liver oils of the ling, skate, shark, plaice, and pollock are of the same order of potency in vitamin A as cod liver oil. Various commercial cod liver oils and several samples of Newfoundland cod liver oils have been found to be as potent as the most active Norwegian oils.

Synthesis of vitamin A by a marine diatom (*Nitzschia closterium*) growing in pure culture, H. L. JAMESON, J. C. DRUMMOND, and K. H. COWARD (*Biochem. Jour.*, 16 (1922), No. 4, pp. 482-485, fig. 1).—Further evidence that marine animals depend upon the marine flora for their supplies of vitamin A, as shown in previous work by Coward and Drummond (*E. S. R.*, 46, p. 356) and by Hjort (*E. S. R.*, 47, p. 661), is furnished in data showing that pure cultures of a common marine diatom (*N. closterium*) grown in Miquel's solution or sterilized sea water synthesize large amounts of vitamin A. This organism in amounts of about 0.08 gm. dry weight daily caused resumption of growth in rats on a vitamin A deficient diet. This amount of diatoms represents approximately 4 mg. of fat, thus indicating that the diatoms are extremely potent as sources of vitamin A. It is of interest that in addition to the characteristic pigment of the brown algae, fucoxanthin, the dried organisms were found to contain chlorophyll and relatively large amounts of the lipochrome pigments carotin and xanthophyll.

The origin of the vitamin A in fish oils and fish liver oils, J. C. DRUMMOND, S. S. ZILVA, and K. H. COWARD (*Biochem. Jour.*, 16 (1922), No. 4, pp. 518-522).—The data presented in this paper supplement the above study, and furnish convincing evidence that the origin of vitamin A in fish oils can be traced back to its synthesis by marine algae.

Four samples of plankton were found to be highly potent in vitamin A. 0.1 gm. of the dried material promoting rapid growth in rats on a vitamin A deficient diet. Since the plankton live largely on diatoms such as the one noted in the above paper, it is evident that the vitamin has been transferred from the diatoms where it is synthesized to the plankton. Similarly, various small fish and other marine organisms used as food by the higher fish, such as cod, were found to be rich in vitamin A. Rapid growth resulted from the administration of 0.1 gm. daily of caplin, 1 gm. of sprat, and 0.4 of young herring, and good growth from 4 gm. of muscle, 1 of periwinkle, and 0.01 gm. of the unsaponifiable matter of shrimps. Of these species, the periwinkle feeds directly upon algae, and it is of interest in this connection that the fat extracted from the periwinkle is deeply colored with chlorophyll and other pigments.

Studies on qualitative undernutrition.—I, Rat beriberi, F. HOFMEISTER (*Biochem. Ztschr.*, 128 (1922), No. 4-6, pp. 540-556, fig. 1).—This paper presents an elaborate description of the symptoms and anatomical changes in rats suffering from a lack of vitamin B.

In the author's experience four definite periods can be distinguished in the course of the disease. The first is an incubation period or prodromal state, characterized by loss of appetite and weight after a preliminary period in which there may be a slight gain in weight. This first period generally lasts about 20 days when the diet is completely lacking in vitamin B. If the diet contains traces of vitamin B the period is prolonged. This period is followed by a state of ataxia, characterized principally by loss of initiative and lack of muscular control. The third period is characterized by spasms, and the fourth and last by paralysis. The last three periods may follow one another in rapid succession or with an interval of a few days. In very acute cases the third period may be entirely lacking, the animal becoming paralyzed after losing the control of its muscles without passing through the spastic state.

The anatomical changes observed are summarized as follows: In rat beriberi an anatomically recognizable degeneration of the peripheral nerves is completely lacking even in the most pronounced cases. All of the severe cases are accompanied by alterations in the central nervous system, particularly multiple hemorrhages in the cerebellum and at the base of the brain, and degeneration of the nerve cells. The extent and severity of the hemorrhages correspond closely to the intensity of the various symptoms during life. They are lacking or scanty in cases in which the diagnosis of beriberi has been doubtful.

The pathological-anatomical diagnosis is, therefore, considered to be not a form of polyneuritis but multiple hemorrhages of the brain similar to those observed in hemorrhagic encephalitis or chronic poisoning with lead and arsenic preparations. On this basis the function of vitamin B is considered to be as follows: The functioning cells of the nervous system, the ganglion cells, require vitamin B. If this is lacking they quickly stop functioning and degenerate. In man and fowls the peripheral nerves are affected first and to the greatest extent, and in rats and pigeons the central nervous system. Whether the hemorrhages are due to a direct starvation of the vascular bundles independent of nerve degeneration, or whether the alterations in the vascular system are dependent on the nerve starvation, has not yet been determined. The occurrence of edema in certain places is thought to indicate a permeability of the vascular tissues similar to that in scurvy though differently localized. That lack of vitamin B is not concerned with the starvation of the nerve cells alone is thought to be indicated by its inhibiting effect on growth. It is emphasized in conclusion that while lack of vitamin B is primarily concerned with derangement of the nerve cells, its significance in intermediary metabolism and its function to other organs must not be overlooked.

Sunlight and rickets (*Brit. Med. Jour.*, No. 3198 (1922), pp. 611, 612).—An editorial discussion of recent papers on the etiology of rickets.

Ultraviolet radiation in rickets.—Effect on the calcium and inorganic phosphorus concentration of the serum, B. KRAMER, H. CASPARTS, and J. HOWLAND (*Amer. Jour. Diseases Children*, 24 (1922), No. 1, pp. 20-26, figs. 5).—Five children, four colored and one white, showing clinical and X-ray evidences of rickets, were given ultraviolet light treatment by daily exposure to the rays of a mercury vapor quartz lamp. Roentgenograms were made before and several times during the treatment, and determinations of the calcium and inorganic phosphate of the blood serum were made at least three times during the treatment. The treatment was followed in each case by healing of the rachitic process in the bones and by an increase in the inorganic phosphorus concentration of the serum. The colored children are said to have required no more intensive treatment than did the one white child.

The inorganic phosphate content of breast milk of mothers with normal and with rachitic infants, L. VON MEYSENBERG (*Amer. Jour. Diseases Children*, 24 (1922), No. 3, pp. 200-203).—The inorganic phosphate content was determined of the milk of 17 mothers of nonrachitic infants and 11 mothers of rachitic infants, and similar determinations were made on the blood serum of 8 of the infants in each group.

The average phosphate content of the milk of mothers of nonrachitic infants was 4.08 mg. per 100 cc. and of rachitic infants 4.8 mg. Similar averages for the blood serum of nonrachitic and rachitic infants were 5 and 2.8 mg., respectively. These results appear to indicate that the reduction in phosphate of the serum of rachitic breast-fed infants can not be attributed to a decrease in the phosphate content of the milk.

An ethereal extract of strawberries for the treatment of sprue, A. CASTELLANI and K. C. BROWNING (*Brit. Med. Jour.*, No. 3201 (1922), p. 718, fig. 1).—

In this preliminary note a convenient apparatus for the continuous extraction of a solution with a light solvent is described and illustrated. An alcoholic extract of fresh strawberries, further extracted with light petroleum ether and evaporated on starch in vacuo over phosphorus pentoxid, is said to have given good results in a limited number of observations in the dietetic treatment of sprue.

Development of the paratyphoid-enteritidis group in various foodstuffs. S. A. KOSER (*Jour. Infect. Diseases*, 31 (1922), No 1, pp 79-88).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the extent to which organisms of the paratyphoid-enteritidis group can multiply in various food products under ordinary household conditions.

All of the strains tested multiplied readily in the liquor of several cooked vegetables with the exception of sauerkraut. In fruit juices there was a rapid destruction of the organism, and in meat products not only a rapid multiplication at the point of inoculation but penetration to other parts of the product. Growth in all cases was more rapid at 37° C. than at lower temperatures. In some of the vegetables the rapid growth occurring at first was followed after the first two days by a decline evidently caused by acid production.

In most cases there was no visible growth of the organism, nor was the taste or flavor sufficiently altered to give evidence of contamination. In consequence of inability to detect this contamination, the necessity is emphasized of thorough cooking of all foods, especially those which have been exposed to an incubation period.

Report of an outbreak of botulism. C. G. BEATT (*Jour. Amer. Med. Assoc.*, 79 (1922), No 1, pp. 38, 39).—The outbreak reported, which occurred at the Lakeside Hospital at Kendallville, Ind., in March, 1922, was definitely traced to commercially canned spinach, which was found to contain type A botulinus toxin. Seven of the nine persons who developed symptoms of botulism were treated with type A serum and some of these also with mixed type A and B serum. There were four fatalities, including two of those receiving serum treatment.

ANIMAL PRODUCTION.

Vitality of spermatozoa. W. S. ANDERSON (*Kentucky Sta. Bul.*, 239 (1922), pp. 3-36, figs. 7).—This work is divided into two parts.

I. *The vitality of the spermatozoa of some domestic animals* (pp. 3-25).—The author describes the spermatozoa of the stallion, bull, rooster, and man, with an explanation of their formation, after which a series of experiments are reported in which semen of stallions and roosters were especially studied with regard to composition, length of life, acidity, etc.

The spermatozoa in 24 samples of vigorous horse semen kept in the laboratory at 22° C. began to decrease in movement in 2 hours, followed by complete loss of movement in 6 hours. At 38° there was a complete loss of movement in 4 hours. Ordinary light seemed to have no effect on the length of life of the spermatozoa, though direct sunlight increased their activity but decreased the length of life to less than 2 hours. Temperatures above 44 to 46° decreased the activity and shortened life, though a few spermatozoa were found to live as long as 45 to 50 minutes at this temperature. Freezing killed the spermatozoa, but some were able to live for 1 hour and 40 minutes at 0°.

Semen taken from the testicles of a previously demonstrated fertile rooster was found to be inactive, but activity was started by diluting this semen with water or physiological salt solution. The properties of semen from roosters, as well as semen from bulls and boars, have been found to be similar to those of

the horse. All activity of the spermatozoa of the horse was destroyed by the addition of solutions of 0.045 per cent HCl, H_2SO_4 , HNO_3 , $\text{C}_2\text{H}_5\text{O}_2$, or $\text{C}_6\text{H}_5\text{OH}$; 0.0675 per cent KMnO_4 ; and 0.25 per cent $\text{C}_2\text{H}_5\text{OH}$. Normal horse semen was found to vary in pH value from 6.94 to 7.51, with an average of 7.31 as compared with variations from 7.49 to 7.76, averaging 7.58 for semen which was inactive. Considerable difference was manifest in the chemical composition of a few samples of normal and abnormal semen as shown by analyses.

To determine the life of spermatozoa in the womb, a number of hens and three mares were killed at varied intervals after breeding and the genital organs examined for live spermatozoa. The outstanding results of these tests indicate that the fluids of the genitals tend to prolong the life of the spermatozoa, as active sperms were found in all hens killed from 6 to 8 hours after breeding, though none were found after 15 hours, and in one mare all spermatozoa were very active after 7.25 hours.

II. *The vitality of the spermatozoa of some sea animals* (pp. 26-36).—This is a report of studies and observations on the vitality of the spermatozoa of the oyster (*Ostrea virginica*), hard shelled clam (*Venus mercenaria*), and mud snail (*Nassa obsoleta*) carried on at the Carnegie Institute for Experimental Evolution at Cold Spring Harbor, N. Y., during July and August, 1916.

The spermatozoa of the oyster and clam were found to be immotile until activated by the NaCl in sea water. Normal activity was observed in 2 to 3.5 per cent solutions of NaCl, but greater or less concentrations decreased the activity. Dilute solutions of alkalis, as well as 10 to 15 per cent solutions of alcohol did not injure the activity of the spermatozoa, whereas very dilute solutions of acid were injurious. The vitality of the sperms in the mud snail resembles that of the mammals rather than the oyster and clam, due to the method of fertilization.

Animal nutrition work (*Iowa Sta. Rpt. 1921, pp. 36-38*).—A progress report is given of the studies of the acid-base balance in swine (E. S. R., 47, p. 375). The second generation acid-fed sows have farrowed fall litters which are doing as well or better than the controls. Rats and rabbits are now being fed acid rations and trials to prevent the formation of urinary calculi in western feeder lambs are in progress in which acid or alkali is added to the drinking water. Rabbits have been found to require more vitamin A than rats or swine. Studies of the vitamin deficiency of chickens has been complicated with the occurrence of leg weakness.

Better silage by adding a legume (*Arkansas Sta. Bul. 181 (1922), pp. 60, 61*).—Two years' trials by H. E. Dvorachek and R. H. Mason have shown that it is not practical to harvest cowpeas with corn for silage, and planted separately they are too hard to mix in the silo. Soy beans have been very satisfactory, however, planted with corn, and a larger yield per acre has been obtained than with corn alone. As a feed for dairy cows this silage also proved 10 per cent more valuable than straight corn silage. Soy beans and cane drilled in after wheat proved satisfactory one year but were frosted the other year.

[Experiments with beef cattle at the Arkansas Station] (*Arkansas Sta. Bul. 181 (1922), pp. 56-60, figs. 2*).—The calves of scrub beef cows sired by purebred sires are showing considerable improvement over their dams, especially in the second generation.

In tests by H. E. Dvorachek and H. E. Reed, beef cows carried on pasture until December 1 and then given the run of a stalk field to January 1 were used to compare different roughages as feeds for beef cattle from January 1 until grass time. In 1919-20 cane and soy beans were used, in 1920-21 corn

silage and cottonseed meal, and in 1921-22 shock corn. The cows were in the best condition after wintering on the corn silage and cottonseed meal, but this was the most expensive winter ration. The other two rations gave about the same results as far as the condition of the cows was concerned, but the cane and soy beans could be raised on wheat land, whereas the shock corn required the use of the land for the entire season. The conclusion from this work is that cattle can be satisfactorily wintered on cheap home-grown roughages.

Fattening cattle (*Nebraska Sta. Rpt. 1921, pp. 17, 18*).—In an experiment to determine the effect of age on the economy of gain, 10 2-year-old, 10 yearling, and 10 calf steers were fed for 200 days on a ration of corn (42 cts. per bushel), silage (\$6 per ton), alfalfa (\$10 per ton), and linseed meal (\$50 per ton). The average initial weights per head for the lots at the start were for the 2 year-olds 784.8 lbs., yearlings 562.2, and calves 380.7 lbs. The respective average daily gains for the 200-day feeding periods were 2.21 lbs., 2.21, and 2 lbs. at costs per 100 lbs. of gain based on the above feed prices of \$8.94, \$7.68, and \$6.93, respectively.

In another experiment 50 western steers were divided into 5 lots and fed for 127 days on the following rations: Lots 1 to 4, corn and alfalfa, with the addition of silage in lots 2, 3, and 4, as well as alfalfa molasses meal in lot 3 and linseed meal in lot 4. Lot 5 received alfalfa, silage, and linseed meal. With alfalfa molasses meal calculated at \$30 per ton and the other feeds at the above prices, the costs per 100 lbs. of gain were for lot 1 \$8.72, lot 2 \$10.50, lot 3 \$13.40, lot 4 \$11.75, and lot 5 \$12.56. The respective average daily gains were 2.15 lbs., 1.83, 1.71, 2.30, and 1.93 lbs. per head. Lots 1 and 4 were evidently finished best, as they brought the best prices per pound.

Winter rations for breeding ewes, J. W. HAMMOND (*Ohio Sta. Bul. 358 (1922), pp. 127-196, figs. 16*).—Seven experiments are reported in which different rations, including common home-grown Ohio roughages, were compared for wintering breeding ewes from 1913 to 1920 at the Southeastern Test Farm. The ewes used consisted mostly of high-grade Merinos of the C or light B types, which were bred to Southdown, Merino, and Shropshire rams. All comparative lots were made up as equal as possible as to the breeding of the ewes, the rams which they were bred to, age of the ewes, etc. In experiments 1 to 4, the lots lettered A received the same rations as the correspondingly numbered lots, but the A lots were composed only of 2-year-old ewes, whereas the other lots were composed of ewes from 3 to 9 years of age. The ewes in experiments 5, 6, and 7 ranged from 2 to 8 years of age. In experiments 1 to 4 the feeds consisted of corn, linseed meal, clover hay (composed of some soy bean and mixed hay), and corn silage made from well-matured corn.

Comparisons were made of rations in which all of these feeds were used (lots 3 and 4), with rations lacking linseed meal (lots 2), lacking clover hay (lots 5), and lacking both linseed meal and silage (lots 1). More linseed meal was fed to the ewes in lots 4 than to those in lots 3. By comparing the A lots with the other lots, it was possible to compare the different rations for aged ewes and for 2-year-old ewes.

In experiments 5, 6, and 7 the feeds consisted of corn, cottonseed meal, alfalfa hay, corn stover, and corn silage. Rations consisting of corn and alfalfa hay (lots 1) were compared with rations of corn, cottonseed meal, and silage (lots 2), with a heavy feed of alfalfa hay (lots 5), medium feed of alfalfa hay (lots 6), light feed of alfalfa hay (lots 7), and corn stover (lots 8). Lots 3 were fed like lots 2 and 6 on alternate days, and lots 4 were fed like lots 2 during the first half of the test and like lots 6 during the second half.

The data for each test are presented in tabular form, much of which is summarized in the following table:

Summary of results with comparative rations for wintering breeding ewes.

Experiment.	Lot.	Length of test.	Number of ewes	Average daily ration consumed.				Average daily cost of feed per ewe.	Weight of lambs born.	Weight of wool shorn.	Average daily gain per ewe.
				Corn	Linseed ¹ or cottonseed ² meal.	Hay. ³	Corn silage				
		Days.		Lbs.	Lbs.	Lbs.	Lbs.	Cents.	Lbs.	Lbs.	Lbs.
I.....	3	95	29	0.51	0.12	0.47	3.25	1.79	155.00	244.10	0.142
	4	95	28	.30	.33	.47	3.40	1.90	175.00	244.20	.142
	5	95	29	.31	.32	.....	4.06	1.80	141.25	242.20	.154
	3A	95	30	.53	.10	.47	2.71	1.65	153.50	311.00	.123
	4A	95	29	.36	.27	.46	2.77	1.75	127.50	293.00	.123
II.....	2	124	27	.48	.....	.71	3.30	1.66	251.25	214.40	.056
	3	124	27	.37	.12	.71	3.48	1.75	239.50	236.00	.121
	4	124	27	.12	.36	.71	3.59	1.89	250.25	225.90	.120
	5	124	27	.19	.29	.....	4.30	1.64	193.50	209.20	.102
	3A	124	14	.38	.10	.69	2.97	1.65	96.00	141.00	.125
III.....	4A	124	14	.16	.32	.69	3.18	1.82	124.00	137.40	.155
	1	126	23	.57	.....	2.44	.....	1.98	221.00	181.50	.063
	2	126	24	.46	.....	.74	2.96	1.58	201.75	180.00	.008
	3	126	24	.35	.11	.74	3.18	1.67	202.75	189.00	.038
	4	126	23	.08	.38	.73	3.73	1.92	165.75	174.00	.056
IV.....	5	126	22	.19	.27	.....	3.89	1.55	164.75	159.75	.....
	2A	126	13	.46	.....	.73	2.96	1.58	101.75	115.75	.014
	3A	126	12	.34	.12	.73	3.43	1.72	83.50	109.50	.085
	4A	126	13	.10	.36	.73	3.53	1.87	106.75	122.25	.067
	3	95	21	.63	.12	.48	3.27	1.93	207.50	165.30	.053
V.....	4	95	21	.40	.35	.48	3.58	2.11	196.25	172.70	.067
	1	126	21	.77	.....	2.45	.....	2.47	194.50	175.50	.073
	2	126	20	.18	.26	.....	4.41	1.53	177.75	123.60	.038
	3	126	20	.27	.23	.....	4.63	1.69	186.00	147.30	.035
	4	126	.....	.27	.25	.....	4.14	1.74	178.00	125.70	.075
VI.....	5	126	20	.50	.14	1.04	3.13	2.12	187.25	134.70	.111
	6	126	21	.34	.19	.59	3.51	1.79	196.25	147.30	.052
	7	126	20	.28	.25	.35	4.18	1.78	171.50	138.80	.086
	8	126	20	.31	.33	.....	3.91	2.03	182.50	133.70	.099
	1	126	23	.84	.....	2.66	.....	2.68	187.75	145.80	.081
VII.....	2	126	23	.19	.26	.....	4.44	1.54	194.25	106.40	.....
	3	126	23	.28	.22	.....	4.60	1.65	190.75	148.20	.018
	4	126	.....	.29	.25	.....	4.65	1.73	202.25	130.40	.015
	5	126	23	.51	.14	1.02	3.02	2.08	207.25	162.60	.048
	6	126	23	.36	.19	.59	3.50	1.79	201.25	143.00	.021
VIII.....	7	126	23	.29	.23	.33	3.97	1.71	211.00	135.60	.004
	8	126	23	.30	.29	.....	3.67	1.89	213.50	131.00	.031
	1	126	22	.86	.....	2.61	.....	2.64	181.25	173.70	.025
	3	126	22	.31	.23	.....	4.00	1.71	213.00	194.25	.052
	4	126	.....	.33	.25	.....	4.25	1.84	192.00	162.30	.066
IX.....	5	126	22	.55	.15	1.05	3.20	2.19	177.75	159.10	.089
	6	126	22	.40	.21	.63	3.73	1.94	188.00	160.60	.043
	7	126	22	.33	.25	.34	4.06	1.80	180.25	145.85	.054

¹ Fed in experiments 1, 2, 3, and 4.

² Clover in experiments 1, 2, 3, and 4, and alfalfa in experiments 5, 6, and 7.

³ Fed in experiments 5, 6, and 7.

⁴ Average only on days when alfalfa was fed.

⁵ Corn stover.

The results of the work indicate that corn silage supplemented with linseed meal or cottonseed meal may efficiently and economically replace a considerable part of the clover or alfalfa hay in a ration, but it was not efficient to replace all the roughage with corn silage, since $\frac{1}{2}$ lb. or more of clover or alfalfa hay per day produced additional vigor and better condition in the lambs at birth, and the lambs made better gains while suckling than when no hay was fed. With only small amounts of alfalfa available, it was found better to feed a little regularly than more for a short period. Corn stover supplemented with cottonseed meal and fed with silage was not as satisfactory a dry roughage as alfalfa hay, but formed a better ration than when silage was the only roughage fed. It was considered economical to feed linseed or cottonseed meal, since the ewes were in better condition at lambing time and produced

more milk and this showed as better gains in the lambs at the close of the test. The amount of protein supplement to feed, however, would be largely determined by the price.

Three years' experiments in which similar ewes were divided into 2 lots each year and fed and cared for in the same manner showed that the variations which could be normally expected with the same treatment in different lots should not exceed 10 per cent. The average weights of fleeces during one year, however, differed by 12.5 per cent, and the calculated average daily gains of the ewes differed by 16.28 per cent during one of the experiments.

Wintering the pregnant ewe (*Iowa Sta. Rpt. 1921, p. 22*).—Adding $\frac{1}{2}$, $\frac{1}{2}$, and 1 oz. of potassium carbonate daily to a basal ration of 3 lbs. of corn silage, 1 lb. of clover hay, and 1 lb. of a grain mixture for 9 ewes having access to block salt was found to decrease the salt consumption. The grains of all lots were practically the same, but the wool yields of the lots receiving the potassium carbonate were several pounds heavier.

[Fattening lambs at the Nebraska Station] (*Nebraska Sta. Rpt. 1921, pp. 18, 19, 35, 36*).—The lamb feeding experiments (E. S. R., 45, p. 574) at the station and at the Scottsbluff Substation were continued during 1920–21. At the station 6 lots containing 30 lambs each were fed for 112 days beginning November 9, 1920, to ascertain the advisability (1) of adding silage to rations of corn and alfalfa, (2) of feeding molasses with and without silage, and (3) feeding linseed meal with and without silage for fattening lambs. All lots received shelled corn and alfalfa hay, with the addition in lot 2 of silage, lot 3 of molasses meal, lot 4 molasses meal and silage, lot 5 linseed meal, and lot 6 linseed meal and silage. The average daily gains varied from 0.258 lb. per day in lot 2 to 0.339 lb. per day in lot 5. The gains were in all cases greater and cheaper where no silage was fed. The addition of molasses meal apparently had no effect on the gains but increased the cost. Linseed meal increased both the amount of gain and the cost of gain.

In the experiments at Scottsbluff 12 lots of 25 lambs each averaging 44 lbs. in weight were fed for 120 days in experiments to compare the efficiency of certain feeds as supplements to alfalfa hay fed ad libitum. The results showed that corn produced cheaper gains than dried beet pulp. Cottonseed cake fed with corn and dried beet pulp increased gains and lowered the cost. Beet tops produced a little more gain at less cost than corn silage, and they were cheap feeds to accompany corn and dried beet pulp in the ration.

Sheep-killing dogs, M. W. COLL. (*U. S. Dept. Agr., Farmers' Bul. 1268 (1922), pp. 29, figs. 2*).—This publication deals with the injury which sheep-killing dogs have done to the sheep industry as a whole, after which some suggestions are offered for better control of dogs inclined to kill sheep, followed by a digest of the existing State dog laws and the complete text of the Michigan act of 1921.

[Experiments with swine at the Arkansas Station] (*Arkansas Sta. Bul. 181 (1922), pp. 45–47, 48, 49, 52–56, fig. 1*).—Of 3 razorback sows purchased in 1920, 2 were bred at the station by a Poland China boar and 1 had been previously bred to a scrub boar. The latter farrowed 9 pigs, of which 5 were weaned and sold at about 8 months of age, weighing an average of 172 lbs. each. The other 2 sows had litters of 6 and 9 each. The litter of 9 weighed an average of 97 lbs. at 5 months of age, and the 4 barrows in the other litter weighed 194 lbs. at 9 months of age. The 2 gilts from this litter were bred to a Duroc-Jersey boar and farrowed 10 and 11 pigs, respectively, and 9 of the last litter averaged 72 lbs. at 4 months of age. Two of the original sows, which weighed 72 and 85 lbs. at the time of purchase, weighed when marketed 210 and 315 lbs., respectively.

In tests by H. E. Dvorachek et al., hand-feeding as compared with self-feeding swine was found to require more labor. The gains and feeds required for gain were practically the same.

Two years' experiments by Dvorachek in wintering brood sows with alfalfa hay, cowpea hay, soy bean hay, and tankage as protein supplements to corn showed practically equal results for all the hays, but with the cowpea hay lot, less pigs per litter were farrowed, which averaged more in weight and contained a larger percentage of strong pigs. The tankage was found to be inferior to the legumes. The following amounts of hay were consumed per sow per day: 0.17 lb. of alfalfa hay, 0.32 lb. of soy bean hay, and 0.24 lb. of cowpea hay.

In tests at the station cottonseed meal, peanut meal, and dairy by-products have been found to be valuable sources of protein to replace tankage in the rations of fattening shotes. Winter rye has furnished more pasture both in winter and spring than either winter oats or winter wheat. Alfalfa and red clover have also proved desirable pasture crops.

[Cracked peas v. tankage as supplements to barley for finishing pigs] (*Idaho Sta. Bul. 129 (1922), p. 9*).—One lot of spring pigs was fed cracked peas as a supplement to rolled barley and the gains compared with another lot fed tankage. The ratio of barley to peas was 3:1 and of barley to tankage 91:9. Approximately equal gains were made in both cases.

Feeding minerals to hogs on rape, J. M. EYVARD, C. C. CULBERTSON, and W. E. HAMMOND (*Chester White Jour., 13 (1922), No. 5, pp. 6-8*).—In a feeding experiment which began July 1, 1921, at the Iowa Experiment Station, 12 lots of 10 pigs averaging 53 lbs. each on rape pasture and receiving shelled corn self-fed and 0.3 lb. each day of a feed mixture of 40 per cent corn germ meal, 40 per cent linseed meal, and 20 per cent meat meal, were allowed different mineral mixtures and the relative gains and time required for the pigs in each lot to average 225 lbs. compared. Lots 1 and 12 were check lots and received no minerals. Lots 2 and 3 received a mineral mixture of equal parts of salt and limestone, lots 4 and 5 a mixture of equal parts of salt, limestone, and spent boneblack; lots 6 and 7 a mixture of 30 per cent salt, 10 per cent limestone, 25 per cent boneblack, 0.3 per cent potassium iodid, 10 per cent sulphur, 12 per cent wood ashes, 5.7 per cent Glauber's salt, 5 per cent Epsom salts, and 2 per cent copperas; lots 8 and 9, 34.36 per cent salt, 11.46 per cent limestone, 28.64 per cent boneblack, 0.34 per cent potassium iodid, 11.46 per cent sulphur, and 13.75 per cent wood ashes; and lots 10 and 11, 38.81 per cent salt, 12.94 per cent limestone, 32.34 per cent boneblack, 0.39 per cent potassium iodid, and 15.52 per cent wood ashes. The following table gives a summary of the results of this test:

Feed consumed and gains made by pigs receiving different mineral mixtures.

Lot.	Days to average 225 lbs.	Average daily gain per pig.	Average daily feed consumed.				Feed consumed per 100 lbs. gain.	Lot.	Days to average 225 lbs.	Average daily gain per pig.	Average daily feed consumed.				Feed consumed per 100 lbs. gain.
			Corn.	Feed mixture.	Mineral mixture.	Corn.					Feed mixture.	Mineral mixture.			
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.				Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
1.....	179.5	0.96	4.66	0.30		519	7.....	139.5	1.23	4.82	0.30	0.012		417	
2.....	127.0	1.88	4.83	.30	0.019	376	8.....	127.5	1.85	4.81	.30	.019		379	
3.....	182.0	1.80	4.84	.30	.012	397	9.....	126.5	1.86	4.96	.30	.012		387	
4.....	181.5	1.81	5.07	.30	.019	411	10.....	137.0	1.81	4.92	.30	.019		400	
5.....	128.0	1.83	5.09	.30	.011	408	11.....	126.8	1.83	4.86	.30	.012		387	
6.....	124.0	1.89	5.11	.30	.019	391	12.....	144.5	1.19	4.79	.30			427	

It may be noted that all of the pens receiving minerals reached the weight of 225 lbs. in less time and required less feed per 100 lbs. of gain than was required by either of the check pens.

[**Swine feeding experiments at the Iowa Station**] (*Iowa Sta. Rpt. 1921, pp. 22, 23, 24, 25*).—In another year's results (E. S. R., 46, p. 362) of experiments to determine the effects on orphan pigs of adding certain substances containing vitamin B in abundance to the ration, 4 lots of 2 pigs each were fed for 120 days on shelled corn, meat meal tankage, and block salt self-fed, and 1 qt. of whole milk daily per pig for the first 60 days. The check lot receiving only the above feeds and a lot receiving in addition one cake of yeast foam per pig per day averaged 55 and 53 lbs. in weight, respectively, at 120 days of age. The pigs of another lot receiving an additional four cakes of yeast foam per pig per day, however averaged 80 lbs. in weight at this age.

Preliminary experiments have shown that swine also need the fat-soluble vitamin for growth. In comparing the standard corn belt ration of free-choice, self-fed shelled corn, tankage, and salt on rape pasture with commercial feeds, it was found that in all but one case the margin above feed costs was greater with the corn belt ration. The exception was with the commercial feed composed of hominy feed, tankage, and salt.

In tests in which three of the mineral mixtures noted above (slightly modified) were fed to pregnant gilts being wintered in dry lot on shelled corn and tankage, the gilts having access to all the mixtures in separate self-feeders farrowed pigs a littler stronger, in better condition, and with larger bones than the others. These pigs, however, ate more of the mixture of precipitated calcium carbonate and salt than of the other mixtures.

Tests of different protein supplements with shelled corn for fattening fall pigs in dry lot showed the greatest gains with Swift's 60 per cent protein tankage and fish meal self-fed, followed by the lot receiving only the supplement of Swift's 60 per cent tankage. A lot receiving leather meal containing 80 per cent protein made very poor gains. Other supplements used included Wilson's regular and degreased tankage and a 40 per cent tankage.

[**Hog feeding experiments at the Nebraska Station**] (*Nebraska Sta. Rpt. 1921, pp. 20, 21, 23*).—In two tests carried on with protein supplements for hogs on a basal ration of corn and tankage, it was found that the addition of shorts to the ration decreased the gains and increased the cost. Semisolid buttermilk, Milkoline, and Ton Gers powdered buttermilk hog builder increased the gains, but the costs of gains were also increased as in previous experiments (E. S. R., 45, p. 171).

One lot of 10 pigs fed for 147 days on a ration of 9 parts yellow corn and 1 part 60 per cent tankage made average daily gains of 1.01 lbs. per head as compared with daily gains of 0.78 lb. made by pigs on a similar ration except that white corn replaced the yellow corn. The respective costs per 100 lbs. of gain were \$15.08 and \$16.69.

Methods and cost of raising pigs to the weaning age, D. T. GRAY and E. H. HOSTETLER (*North Carolina Sta. Bul. 244 (1922), pp. 15, figs. 3*).—Experiments in determining the methods and cost of raising pigs to weaning age were carried on at the Pender farm for 4½ years, the Iredell and Edgecombe farms for nearly 6 years, and the Cotton Valley farm for slightly less than 1 year. The hogs used consisted of purebred Poland Chinas at the Iredell farm, purebred Berkshires at the Pender and Edgecombe farms, and grade sows bred to purebred Berkshires at the Pender and Edgecombe farms, and

grade sows bred to purebred Berkshires or Duroc-Jersey boars at the Cotton Valley farm. The sows were bred to farrow in the spring and fall, each sow having an individual house for shelter except at the Cotton Valley farm. The plan was to have the sows on pasture throughout the summer months, with supplementary grain feeding in the winter. Records were kept in most cases of the feed and pasture consumed, time required in caring for the sows, pigs farrowed, and weight of the sows and pigs at farrowing time and at weaning time, as well as various other data which are reported in the following table:

Summary of methods and costs of raising pigs to weaning age.

Farm.	Averages of fall litters.			Averages for spring litters.			Average weight of pigs from sows.		Effect of shrinkage in weight of sow.		Average number of pigs in litters of sows.	
	Pigs per litter.	Weight per pig.	Cost per pig.	Pigs per litter.	Weight per pig.	Cost per pig.	In-creasing in weight during suckling.	De-creasing in weight during suckling.	Average shrinkage while suckling pigs.	Average weight of pigs.	First litters.	All litters of same sows.
		Lbs.			Lbs.		Lbs.	Lbs.	Per ct.	Lbs.		
Cotton Valley	7.08	26.0	\$4.11	6.08	32.5	\$4.46	33.8	29.5	14.7	20.4	7.6	7.4
Pender.....	6.80	30.0	3.90	5.71	32.2	4.12	30.5	30.6	8.1	30.4	6.2	7.0
Iredell.....	6.05	22.8	3.82	5.87	27.7	4.20	27.1	25.1	+5.9	30.3	7.2	7.2
Edgecombe..									5.1	25.8		

Farm.	Average number of pigs per litter farrowed by sows weighing—				Average weight of each pig at weaning farrowed by sows weighing—				Cost of raising pigs to weaning time (70 days).		
	Under 200 pounds.	200-250 pounds.	250-300 pounds.	Over 300 pounds.	Under 200 pounds.	200-250 pounds.	250-300 pounds.	Over 300 pounds.	Feed consumed.		Labor.
									Before farrowing.	While suckling.	
Cotton Valley					Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Hours.
Pender.....	6.7	6.4	6.1	5.8	28.9	27.8	34.3	30.6	17,247	35,070	626.5
Iredell.....	4.0	6.0	6.1	6.7	29.5	30.0	29.9	30.9	11,666	58,062	726.7
Edgecombe..	4.8	6.2	6.1	5.9	24.7	22.4	27.3	30.2	11,503	39,809	983.5
									16,961	44,941	1,674.4

Other data given showed the average cost per pig at weaning time to be in litters of 2 pigs \$11.42, 3 pigs \$8.12, 4 pigs \$5.13, 5 pigs \$4.75, 6 pigs \$4.44, 7 pigs \$3.73, 8 pigs \$3.10, 9 pigs \$3.24, and 10 pigs \$2.58. The number of pigs in the litter seemed to have little to do with the weight of the individual pigs at weaning time, though the pigs in the larger litters were somewhat lighter. The average number of pigs farrowed per litter at the four farms were very uniform, being 7.3 at two of the farms and 7.4 at the other two, of which 80.8 to 84.9 per cent were raised except at the Cotton Valley farm where only 48.6 per cent of the pigs farrowed were raised due to inadequate shelter.

The question of swine type (*Iowa Sta. Rpt. 1921, pp. 23, 24, 62*).—As in previous tests (E. S. R., 46, p. 362), the small type of swine was found to be excelled by the medium and large types during 1920–21.

Horse raising in colonial New England, D. PHILLIPS (*New York Cornell Sta. Mem. 54 (1922), pp. 883–941*).—This work consists of a history of horse raising in New England compiled from an extensive bibliography which is listed. From the first importation of horses, which probably occurred about 1629, the horse-breeding operations of New England, having their foundations in Massachusetts, Rhode Island, and Connecticut, are described, dealing with the difficulties resulting from free ranges and horse stealing, which was very common, especially when large numbers of horses began to be exported to the British West Indies for use in the manufacture of sugar, which was being produced in large amounts by 1670.

The importation of New England horses by the British sugar colonies increased rapidly, with some interruptions, until about the start of the Revolutionary War. A decrease in the importation of horses which occurred at that time was not only due to the fact that New England vessels were denied entrance to the British Islands, but also to the development of machinery in the manufacture of sugar which used water and wind as power.

About this time, however, the Narragansett pacer was reaching its highest stage of perfection, and large numbers of the best animals were exported in the succeeding years as saddle horses for the prosperous planters in Cuba and the French Islands. Such extensive exportations, as well as a scarcity of pasture and the development of better roads, with the need for larger and heavier horses for harness and draft, contributed mainly to the dispersion of this breed from New England to Canada, Kentucky, and Tennessee.

[Experiments with poultry at the Arkansas Station] (*Arkansas Sta. Bul. 181 (1922), pp. 49–52*).—A summary of the State egg-laying contest has shown that the feed required to produce a dozen eggs decreases as the yearly production increases. With average yearly egg productions per bird of 137.6 eggs and 175.8 eggs, the grain consumed per dozen eggs produced was, respectively, 9.53 and 6.8 lbs. Single Comb White Leghorns have been found to be more economical producers than the other breeds entered in all the contests.

Some promising results are reported in developing high-producing hens by the use of males whose mothers are high producers.

By keeping hens for four years it has been found that "hens lay the majority of eggs during their first two laying seasons, and especially during their pullet year if they are early hatched." The old hens also lay mostly in the spring when eggs are cheap.

[Protein for laying hens] (*Idaho Sta. Bul. 129 (1922), p. 12*).—From the first year's study of the sources of protein for laying hens, it was concluded that skim milk was the most profitable source.

The relationship between the weight and the hatching quality of eggs, L. C. DUNN (*Connecticut Storrs Sta. Bul. 109 (1922), pp. 89–114*).—A study of the relation between the weight of 545 eggs laid by 47 White Leghorn pullets and 170 eggs laid by 18 White Leghorns hens from March 14 to April 20, 1921, and the percentage hatchability of these eggs is reported. Data were recorded on each egg, showing the hen which laid it, date laid, date when incubation began, fresh weight, and notes on fertility, death of the chick in shell, or hatching. The eggs of both the pullets and hens were classified according to weight in 2-gm. classes, showing the percentage hatchability of the eggs in each

class. A summary of these results is given in the following table in which the eggs were divided into three classes called light, medium, and heavy :

The hatching quality of light, medium, and heavy eggs from pullets and hens.

Class.	Pullet eggs.					
	Weight.	Number set.	Number infertile.	Number dead in shell.	Number hatched.	Fertile eggs hatched.
	Gm.					Per cent.
Light.....	44-51.9	146	9	58	79	57.66±2.85
Medium.....	52-59.9	304	14	110	180	62.06±1.92
Heavy.....	60-73.9	95	2	52	41	44.09±3.47

Class.	Hens' eggs.					
	Weight.	Number set.	Number infertile.	Number dead in shell.	Number hatched.	Fertile eggs hatched.
	Gm.					Per cent.
Light.....	46-53.9	44	3	9	32	78.0±5.11
Medium.....	54-61.9	96	4	18	74	80.4±2.79
Heavy.....	62-69.9	30	4	10	16	61.5±6.45

The mean weight and hatching percentage of the eggs of individual pullets are arranged in a correlation table and the coefficient of correlation determined as $+0.094 \pm 0.103$, which indicates a lack of correlation. A study of the hatchability of the eggs as compared with the deviation of the weight of the eggs from the average laid by the hens, showed that the eggs which hatched averaged 0.37 ± 0.16 gm. less than the mean weight, whereas those which died in the shell averaged 0.37 ± 0.18 gm. more than the mean weight. As another method of studying this problem, the hatching percentage of the eggs lighter than the mean weight was 60.29 ± 3.38 as compared with 55.06 ± 3.56 per cent for the eggs heavier than the mean weight. Both on the basis of individuals and the entire flock, it was concluded that the heavier eggs did not hatch as well as those nearer average weight, although "the effect of deviations in weight is so small as to explain only a small proportion of the total in-shell deaths, and can not be regarded as an important cause of the variation of fowls in hatchability."

A study of the influence of certain physical qualities of eggs, mainly size and specific gravity, on the fertility, hatching power, and size and rate of growth of chicks (*Nebraska Sta. Rpt. 1921, p. 25*).—Observations on 958 eggs and the subsequent growth of 150 chicks hatched from these eggs led to the conclusions that the specific gravity of eggs is more likely to be influenced by the thickness of the shell than by variations in the protein or fat content, and that no relation existed between specific gravity and fertility, hatchability, or viability and growth rate of the chicks hatched.

Chick feeding (*Iowa Sta. Rpt. 1921, pp. 28, 29*).—Several rations are suggested which have been successfully fed to chicks. The experiments indicated that leg weakness was due to a deficiency of mineral matter. Bone meal and charcoal seemed to supply the deficiency when fed as from 5 to 10 per cent of the ration. Boiled infertile and dead germ eggs are recommended as sources of animal protein. During the first few weeks chicks were found to do satisfactorily without access to green feed or the ground if alfalfa and gravel

were available. The best time to start feeding young chicks was found to be at 60 hours of age.

A study of the nutrient requirements of growing chicks (*Nebraska Sta. Rpt. 1921, pp. 12, 13*).—A brief report of the work previously noted (E. S. R., 46, p. 171) is given, as well as the conclusion that yellow corn is better for producing growth in chicks than white corn.

Home tanning, R. W. FREY, I. D. CLARKE, and F. P. VEITCH (*U. S. Dept. Agr., Dept. Circ. 230 (1922), pp. 22*).—After giving general instructions about buying leather and having hides tanned, the authors give directions for the tanning of sole and harness leather by the bark-tanning and chrome-tanning process and for tanning lace leather by the alum-tanning process.

DAIRY FARMING—DAIRYING.

Studies in the growth and nutrition of dairy calves, I-IV, A. C. McCANDLISH (*Jour. Dairy Sci., 5 (1922), Nos. 3, pp. 301-320; 4, pp. 348-361*).—The four following papers are reported from investigations carried on with purebred and grade Jerseys, Guernseys, Ayrshires, and Holsteins at the Iowa Experiment Station:

I. *The gestation period* (pp. 301-305).—Records of 369 gestation periods showed that the average was 280 days, which did not seem to be affected by the breed or age of the cow, sex of the calf, or season of the year.

II. *The birth weights of calves* (pp. 305-312).—Data showing the birth weights of 369 calves are tabulated according to the breed, sex, age, and weight of cows and length of gestation periods. The weights of the calves varied for the different breeds, the Holsteins averaging 94 lbs., the Ayrshires 66, the Guernseys 64, and the Jerseys 54 lbs. For all breeds the average birth weights for males were found to be 72 lbs., for females 65 lbs., and for all 69 lbs. There seemed to be a slight rise in birth weight of the calves as the cows go from 2 to 5 years of age, after which the calves decrease in size. With an increase in the weight of the cow the calves increase in weight, but the percentage relation between the weight of the calf and the weight of the cow decreases with the larger cows, the averages being 7.3 per cent for 700-lb. cows and 6.1 per cent for 1,200-lb. cows. The length of the gestation period, when near the average, and the season of the year seemed to have little or no influence on birth weight.

III. *The rate of growth of dairy heifers* (pp. 312-320).—The rate of growth in 40 dairy heifers is shown by monthly live weights, height at withers, depth of chest, and width of hocks from birth to producing age, which averaged 29 months, as well as daily weights for 10 days after birth on 1 heifer and 4 bull calves. The studies showed that winter heifers (born between October 1 and March 31) seemed to reach a little greater weight and larger body measurements by the time of freshening than did summer heifers (born between April 1 and September 30). It was also shown that a fairly constant ratio of 1:25 was maintained between weight in pounds and the product of the height, depth, and width in inches in heifers of various ages.

IV. *The feed cost of growing dairy heifers* (pp. 348-361).—Data are presented showing the feed and pasture consumed in growing the 40 dairy heifers used in the preceding study.

The winter and summer calves consisted of, respectively, 4 and 2 Ayrshires, 8 and 7 Guernseys, 9 and 3 Holsteins, and 3 and 4 Jerseys. The weights, gains and feed consumed, and costs are given for each six-months period for winter and summer calves and for all calves. The feeding was liberal to produce maximum development. The calves sucked their dams an average of 3.5

days after birth. A summary of the feeds consumed and costs, based on feed prices in November, 1921, for raising the calves from birth to producing age (average 29 months), is given in the following table:

Average live weights and feed costs per heifer raised.

Kind of calves.	Birth weight.	Weight at producing age.	Daily gain in weight.	Feed consumed.								Total cost of feed.	Cost per pound of gain.
				Whole milk.	Skim milk.	Concentrates.	Silage.	Solling.	Pasture.	Alfalfa hay.	Cane and corn fodder.		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Days.	Lbs.	Lbs.		Cts.
Winter calves.....	68	1,010	1.09	1,516	2,105	3,045	4,086	284	323	3,574	1,128	\$109.89	11.7
Summer calves.....	64	941	1.01	1,815	2,183	2,861	4,468	349	368	2,483	1,801	102.43	11.7
All calves.....	67	982	1.05	1,436	2,135	2,969	4,239	310	341	3,139	1,197	106.81	11.7

[Experiments with dairy cattle at the Iowa Station] (*Iowa Sta. Rpt. 1921, pp. 25-27, 59, 60*).—Using a basal ration of corn silage, legume hay, bran, ground oats, old process linseed meal, and cottonseed meal for dairy cows, ear corn, shelled corn, cracked corn, corn-and-cob meal, and corn meal were compared as to their milk producing value (E. S. R., 45, p. 777). It was found that 100 lbs. of corn meal was equivalent to 125 lbs. of corn-and-cob meal for butter fat production, and that ear corn was 12 per cent less valuable than corn-and-cob meal. There was little difference noted between shelled corn, cracked corn, and corn meal.

Raising dairy heifers on a self-feeder was not found to be satisfactory, as the heifers got too fat and it was not economical. Data are also given on the feed costs of growing dairy heifers and the rates of growth of dairy heifers as noted above.

Cows in high condition have been found to have higher maintenance requirements than when in poor condition (E. S. R., 45, p. 776).

Conclusions are given as to the value of purebred sires for improving scrub and grade cows as previously noted (E. S. R., 45, p. 173).

Coconut meal, gluten feed, peanut meal, and soy bean meal as protein supplements for dairy cows, A. C. McCANDLISH and E. WEAVER (*Jour. Dairy Sci.*, 5 (1922), No. 1, pp. 27-38).—Two feeding trials of 150 days' duration at the Iowa Experiment Station are reported, in one of which peanut meal and soy bean meal were compared with old process linseed meal, and in the other coconut meal and gluten feed were compared with linseed meal for milk production. Three cows were used in the first trial and four in the second. Each trial was divided into five periods of 30 days each, the first 10 days' results of each period being discarded because of the change in feeds. During both trials the animals were fed a basal ration consisting of corn silage, alfalfa hay, and a grain mixture of cracked corn, ground oats, and wheat bran (2:2:1), supplemented during periods 1, 3, and 5 with linseed meal, during period 2 with peanut meal in the first trial and with gluten feed in the second trial, and during period 4 with soy bean meal in the first trial and with coconut meal in the second trial. One part of the protein supplement was fed to two parts of the grain mixture.

In determining the value of the protein supplements, the milk and fat production for one period was to be compared with that for the preceding and following linseed meal periods. There seemed to be practically no difference in the value of these protein feeds with the possible exception of the coconut

meal, with which slightly better production was obtained, though it did not prove as palatable as the other supplements. Practically no change occurred in the live weights of the animals during the tests.

The influence of the plane of nutrition upon the percentage of fat in milk and the properties of the fat, C. H. ECKLES (*Wis. Univ. Studies Sci. No. 2* (1921), pp. 60-75).—This is a brief report of the work previously noted (*E. S. R.*, 36, p. 669).

The identification of the bovine by means of nose prints, W. E. PETERSEN (*Jour. Dairy Sci.*, 5 (1922), No. 3, pp. 249-258, figs. 6).—After taking nose prints of more than 350 cows at the University of Minnesota and elsewhere, the author has determined that this would be an accurate and practical way of identifying cattle, especially where descriptions of coat color, etc., are of little value as marks of distinction.

The taking of the nose print is accomplished by first wiping the nose dry, inking it with a black stamp pad, and pressing some mimeograph or newsprint paper on a board against the nose. The nose print, while enlarging in size, was found not to vary in pattern from 7 weeks to 17 months of age in a number of calves.

Is a preliminary dry milking essential in semiofficial tests? J. B. FITCH, R. B. BECKER, and P. C. MCGILLIARD (*Jour. Dairy Sci.*, 5 (1922), No. 3, pp. 259-272, figs. 3).—To determine the effect of leaving from one-eighth to one-fourth of the milk in the udder on the amount of milk given by cows and the fat percentage of the milk during succeeding milkings, 40 observations were made at the Kansas Experiment Station on 36 different Holsteins, Ayrshires, Jerseys, and Guernseys which showed that the amount of milk was increased in 24 and decreased in 16 cases. The percentage of fat was increased in 26 and decreased in 14 cases, and the amount of fat was increased in 29 and decreased in 11 cases during the two days after leaving the milk in the udder. The average of all observations showed an increase of 3.13 per cent in the amount of milk, 2.58 per cent in the fat percentage, and 5.82 per cent in the amount of fat during the same period.

The results were determined by dividing each test of 9 days' duration into a 2-day observation period after which the cows were milked dry; a 2-day normal official test period; a 1-day interval period, at the last milking of which about one-fourth of the milk was left in the udder; a 2-day abnormal period which determined the effect of leaving the milk in the udder as compared with the normal test period; and a final 2-day observation period.

The development of city milk supply problems, H. A. HARDING (*Wis. Univ. Studies Sci. No. 2* (1921), pp. 29-54).—This is more or less a historical sketch of the ways in which certain problems dealing with milk distribution, prevention of contamination and adulteration, and bacteriology of milk have been solved, with special reference to the part played by H. L. Russell in bringing about these solutions.

The milk supply of Chicago, A. L. AMOTT (*Wis. Univ. Studies Sci. No. 2* (1921), pp. 170-181, figs. 2).—This is a discussion of the source, amount, pasteurization, methods of transportation and distribution, prices, and inspection of the milk used for supplying the city of Chicago, Ill.

A study of the practical value of the Frost little plate method in the routine colony count of milk samples, H. M. HATFIELD and W. H. PARK (*Amer. Jour. Pub. Health*, 12 (1922), No. 6, pp. 478-487, figs. 2).—The results of a number of comparative bacterial counts in different samples of milk, determined by the Frost little plate method (*E. S. R.*, 45, p. 175) and the standard plate method at the research laboratory of the Department of Health, New York City, showed that the little plate count is probably as accurate as any

method for routine laboratory work except where milk contains over 1,000,000 bacteria per cubic centimeter or where certain unusual types of bacteria are present.

The resistance of mold spores to the action of sunlight, J. WEINZIEB (*Wis. Univ. Studies Sci. No. 2 (1921), pp. 55-59*).—In studies to determine the length of time that spores of the common molds could be kept in direct sun light on paper in glass petri dishes without losing their viability, spores were used of *Mucor*, *Aspergillus niger*, *A. fumigatus*, *A. nidulans*, *Oidium lactus*, and *Penicillium glaucum*. The results showed that mold spores were able to withstand from 58 hours to 5 days of continuous exposure to sunlight.

Investigations of abnormal milk, B. SJOLLEMA and J. E. VAN DER ZANDE (*Handel. Genootsch. Melkk., 1921, pp. 9-55*).—The analyses of a large number of samples of abnormal milk are reported for acidity (titration and pH value), oxalic acid content, chlorin, lactose, catalase, calcium oxid, body cells, etc. Some of this milk came from cows immediately after calving and some as long as several weeks after calving. By means of chemical analyses milk from inflamed udders could not be differentiated from milk from udders infected with streptococci and other organisms, but the leucocyte count may be used for such differentiation.

Reducing acidity of cream, W. F. CONWAY (*Butter, Cheese, and Egg Jour., 13 (1922), No. 25, pp. 26, 28*).—A table is suggested for calculating the amount of lime to be added to sour cream in order to reduce it to the proper acidity for churning.

How to use neutralizer, W. F. CONWAY (*Pacific Dairy Rev., 26 (1922), No. 26, p. 14*).—Brief directions, prepared by the University of Wisconsin, are furnished for calculating the amount of neutralizer to add to sour cream before churning.

Odor formers in cream during souring, F. W. J. BOEKHOUT and J. J. O. DE VRIES (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 24 (1920), pp. 1-12, pl. 1*).—After discussing the literature on the subject, the authors report the cultural characters of an organism isolated by them which belonged to the diplococci or streptococci groups and which produced a desirable odor in cream and butter. The aroma was found to be due to the death and decomposition of these organisms. An abstract in German is included.

[Flavor and keeping quality of butter] (*Iowa Sta. Rpt. 1921, pp. 38, 39*).—In comparing the butter made from sweet cream and sour cream, it was found that the larger portion of the butter made from sour cream scored higher for flavor soon after churning, but when kept in storage 9 months the sweet cream butter had the better flavor. Butter made from sour cream pasteurized at 170° F. by the holding method was of slightly better flavor than when the cream was pasteurized at lower temperatures. Pasteurizing at a higher temperature, however, shortened the keeping qualities of the butter. It has been found possible to classify the *Streptococcus lacticus* group of bacteria according to the odors and flavors produced, rate of growth, and temperatures permitting growth.

The significance of yeasts and *Oidia* in pasteurized butter, F. W. BOUSKA and J. C. BROWN (*Wis. Univ. Studies Sci. No. 2 (1921), pp. 131-138, figs. 3*).—A discussion of the influence of *Oidium lactis* and yeast on the spoilage of butter in storage is given.

It was shown at a number of creameries that by properly pasteurizing the cream, using a noncontaminated starter and thorough steam sterilization of the equipment, yeasts and molds were practically absent or present in very

small amounts in the butter, and that the keeping qualities of the butter were materially increased.

Cheesemaking on the farm, J. G. McMILLAN (*N. S. Wales Dept. Agr., Farmers' Bul. 141 (1922), pp. 53, figs. 33*).—The author discusses the manufacture of cheese with special reference to farm conditions. The equipment necessary is described and illustrated, with directions for its use in making Cheddar, Derby, Caerphilly, and other cheeses.

The bacteriology of ice cream, B. W. HAMMER (*Wis. Univ. Studies Sci. No. 2 (1921), pp. 182-199*).—The results of the bacteriological studies of ice cream previously reported (*E. S. R., 41, p. 279*) and other papers are summarized.

The condensation process of preparing an ice cream mix, R. W. PETERSON and P. H. TRACY (*Jour. Dairy Sci., 5 (1922), No. 3, pp. 273-281; also in Ice Cream Trade Jour., 18 (1922), No. 7, pp. 54-56*).—The report of a study of the methods of preparation and bacteriological factors concerned in the condensation process of preparing an ice cream mix includes directions for calculating the amount of milk, butter or cream, sugar, and gelatin required, and the method of determining when the mix has been sufficiently condensed.

Bacterial counts by the plate method on lactose agar incubated at 30° C. for 4 days showed that pasteurizing the mix in the forewarmer at 160-170° F. before condensing at 130° destroyed over 99 per cent of the bacteria in the mix. Homogenizing and freezing were found to slightly increase the bacterial counts in the mix, probably due to the breaking up of bacterial clusters. Studies of the keeping qualities of the condensed mix showed that it could be kept at 32-35° F. for two weeks without being noticeably off-flavor.

VETERINARY MEDICINE.

Poisonous action of red buckeye on horses, mules, cattle, hogs, and fish, C. A. CARY (*Alabama Col. Sta. Bul. 218 (1922), pp. 20*).—This is a report of investigations of the toxic action of *Aesculus pavia*, a shrub which occurs in fertile valleys from Virginia to Florida, Arkansas, and in southern Missouri. It occurs throughout Alabama in woods, along streams, and in almost any moderately fertile soil. The bulletin reports upon tests conducted from 1918 to 1922, the results of which are summarized as follows:

"Of the 12 pigs fed some part of red buckeye plant, only 1 that was fed nuts at the end of the close of a 15-day test showed dullness, sluggishness, and an unsteady gait. Of the 7 mules and horses fed, or given some part of red buckeye plant, only 3 showed slight effect; one was depressed and weak, mucous membranes pale, put head against fence, and then walked backward and forward. One was originally weak and became weaker and had to be helped up, and stools were soft. One exhibited twitching of the upper lip. Of 6 cattle fed or given some part of red buckeye plant, 1 exhibited slight symptoms and 2 exhibited distinct toxic effects. One test of nuts on fish in water proved to be toxic for fish.

"Fresh leaves and flowers seem to be most toxic for cattle, and apparently the early leaves and flowers are most dangerous for cattle. At the time the flowers and leaves come out, the cattle are more inclined to eat them on account of lack of grass or pasture. Possibly the sugar in the flowers gives them palatability. It may be that nuts and roots, or leaves and flowers, are toxic for pigs, but these tests do not show it conclusively. It is doubtful if horses and mules eat red buckeye, and also it is somewhat doubtful if they are susceptible to the poison."

The clinical symptoms which result from its ingestion include "labored, deep respirations, and sometimes accelerated respiration and pulse; temperature may be slightly elevated; motor paralysis, in coordination of movements; twitching of voluntary muscles; at times animal easily excited, and sometimes sluggish and sleepy; pupils dilated; at times excessive flow of saliva; usually has an appetite for ordinary feed."

The recovery of animals is said to take place upon the removal of the plants from the animals' diet.

The problem of poisonous range plants (*Nevada Sta. Rpt. 1921, pp. 10-12, figs. 2*).—Brief reference is made to feeding tests, in which 231 separate tests were made by C. E. Fleming, largely with sheep, on lupines, rabbit brush, bud sage, mountain laurel, salbushes, and buttercup. All of these plants appear to have poisonous properties with the possible exception of certain lupines. Rabbit brush (*Tetradymia*) was found to contain a cumulative poison, it being the only poisonous range plant tested which has been found to have this property. Attempts by M. R. Miller to isolate the poisonous principle of the salbush (*Atriplex canescens*) have resulted in the separation of a number of substances resembling saponins, which have the property of dissolving or digesting the red blood corpuscles.

The preparation of laboratory specimens as an aid to the diagnosis of animal diseases, L. VAN ES and L. V. SKIDMORE (*Nebraska Sta. Circ. 16 (1922), pp. 3-14, figs. 6*).—Directions are given for the collection, packing, and shipping of specimens of materials to laboratories for diagnostic purposes.

The vaccination of guinea pigs against anthrax blood, A. BESEDKA and Y. DE TRÉVISE (*Ann. Inst. Pasteur, 36 (1922), No. 7, pp. 562-566*).—Further evidence is presented that cutaneous vaccination of guinea pigs against anthrax, as previously described (E. S. R., 44, p. 877), confers an immunity against the virus contained in the blood of an animal dead of anthrax.

Bureau of Animal Industry investigations on bovine infectious abortion, E. C. SCHROEDER (*Jour. Amer. Vet. Med. Assoc., 60 (1922), No. 5, pp. 542-561*).—This is a brief survey of the results obtained in the investigations which have been conducted by the Bureau of Animal Industry, U. S. D. A., on bovine infectious abortion, with a summary of the conclusions which have been drawn concerning the occurrence of the organism in the bodies of cattle, the modes of dissemination, channels of infection, tests, treatment, and prevention. Under the last-named topic data are presented on the use of living cultures in the immunization of nonpregnant cattle.

In a large herd numbering over 1,000 head of cattle the results from the injection of live organisms before conception are given as follows: Treated cattle, first year, 13.12 per cent of abortions; second year, 10.29 per cent; and untreated cattle, first year, 17.7 per cent of abortions; second year, 14.09 per cent. The treated animals in the first year numbered 617 and in the second 311, and the untreated in the first year 294 and in the second 142. In another test, 23 cattle were divided into three groups. Eleven received subcutaneous injections of pure living cultures of abortion bacilli about two months before conception, 4 received repeated injection of killed cultures of abortion bacilli after having become pregnant, and 8 remained untreated after exposure to abortion infection by the ingestion of material from actual cases of infectious abortion. There was 1 abortion in the first group of 11, 2 in the second group, and 7 in the control group.

The control of *Bacterium abortus* infection in cattle by vaccination with living bacteria, W. L. WILLIAMS (*Cornell Vet., 12 (1922), No. 2, pp. 110-131; also in North Amer. Vet., 3 (1922), No. 6, pp. 312-322, 354*).—This is a

critical review of the literature on the attempted control of bovine abortion by vaccination with living bacteria.

In the author's opinion the recorded experiments upon small groups of cattle set aside wholly for experiment are unreliable and contradictory in their results. The recorded data from experiments upon groups of herds are also considered to be generally unreliable in that they are made upon herds which have recently suffered from "abortion storms," in which an abrupt decline in abortion rate is to be expected. "The data submitted by Schroeder (see above), the only data upon vaccination yet recorded in a large purebred herd where genital infection has reached saturation, emphatically contradict the claim of value."

The present status of vaccination against abortion disease of cattle, E. C. SCHROEDER (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 4, pp. 363-373).—In this paper the author calls attention to a number of factors that must be taken into consideration before the common use of abortion vaccines should be approved, and reports the results obtained in the application of four simple tests to 24 samples of alleged suspensions of live abortion bacilli purchased in the open market. These tests consisted of the microscopic examination of cover glasses prepared directly from the suspensions, a study of the growth of the cultures on media suitable for the cultivation of the Bang abortion bacilli, the microscopic examination of the growth obtained on the culture media, and tests of the sensitiveness of the suspensions to abortion-positive and abortion-negative blood sera of cattle.

The results obtained were such as to condemn 7 of the 24 samples examined in the first test, 10 in the second, 7 in the third, and 8 in the fourth test. Only 5 of the suspensions proved satisfactory in all four tests. The conclusion is drawn that "vaccination against bovine infectious abortion disease is in the experimental stage."

[Infectious abortion studies at the Arkansas Station] (*Arkansas Sta. Bul.* 181 (1922), pp. 66-69).—A brief account of infectious abortion in cattle is followed by a discussion of the disease as it occurs in swine. In experiments conducted by W. L. Bleecker, milk from infected cows fed either before or during pregnancy failed to produce the disease in pregnant sows. Pure cultures of the organism obtained from infected cows and fed to sows also failed to produce the disease. Such organisms from infected cows, however, produced the disease in a number of cases when intravenously injected into sows. Sows may become infected after eating the aborted calves or pigs and the afterbirth from aborting cows or sows.

Critical review of recent results in foot-and-mouth disease investigations, M. SEELEMANN (*Centbl. Bakt. [etc.]*, 1. Abt., Ref., 73 (1922), No. 17-18, pp. 385-391).—A review of literature, mostly from German sources.

Hemorrhagic septicemia (*Nebraska Sta. Rpt.* 1922, pp. 10-12).—Attempts to induce hemorrhagic septicemia in cattle by injection of virulent cultures of *Bacillus bipolaris* have thus far been unsuccessful, the inoculation resulting in general in a transitory illness characterized by articular disturbances and followed by prompt recovery. In only one case has it been possible to produce a pathological condition similar to the natural infection.

Immune serum against *B. bipolaris* has been found to afford protection against artificial infection, but this protection is of limited duration and in many cases the virus used to test the protection remains latent until after the protection expires and then produces fatal infection. Passive immunity can not be changed into active by further injections of virulent material.

Attempts are being made to immunize fowls against fowl cholera by immune serum prepared by injecting goats with fowl cholera organisms.

Bacteriological analyses of material sent in from different parts of the State have shown that *B. bipolaris* is seldom the cause of disease in swine and cattle.

Immunological studies with the Preisz-Nocard bacillus and their application to ulcerative lymphangitis in the horse. F. C. MINETT (*Jour. Compar. Path. and Ther.*, 35 (1922), No. 2, pp. 71-107).—Following a review of recent literature on equine ulcerative lymphangitis, a report is given of extensive immunological studies in which 10 strains of the Preisz-Nocard bacillus, all but two of which were isolated from lesions of the limbs of horses, were used as the infective agent and rabbits and horses as the experimental animals.

A few preliminary experiments made with living bacilli confirmed the literature reports that no tolerance could be established in rabbits for the living organism. In the later experimental work both heat-killed (from 56 to 60° C. for from $\frac{1}{2}$ to 1 hour in the water bath) and alcohol-ether-killed bacilli were used. When the killed organisms were injected subcutaneously, considerable local disturbance followed in the form of edematous swellings. Intravenous injections were followed by a general disturbance in the form of a rise in temperature and loss of weight, particularly following the first two or three injections. Later in rabbits and in one case in a horse a hypersensitive state developed. Large amounts of the killed organisms injected intraperitoneally into guinea pigs caused toxemia, resulting in death or recovery depending upon the actual weight of the toxic bacilli injected and the method of killing the organism. Alcohol-ether-killed bacilli proved more toxic than heat-killed in both guinea-pig and rabbit inoculations.

Agglutinins, precipitins, complement fixing bodies, antitoxins, and possibly opsonins were all demonstrated in rabbits and horses following injections of the Preisz-Nocard antigen. By means of serum tests it was found that two of the strains differed from the others in serological properties.

Attempts to apply serological methods to the actual diagnosis of ulcerative lymphangitis in the field are also reported. In general the complement fixation test proved reliable but not the agglutination test.

Further tests of the properties of the serum obtained by the injection of heat-killed and alcohol-ether-killed bacilli are reported which show that the serum is antibacterial inasmuch as it contains lysins, agglutinins, etc., definitely inhibits growth of the Preisz-Nocard bacillus *in vitro*, and reduces the infective power of small doses of living bacilli *in vivo*. It is also antitoxic, as in protective experiments it is capable of neutralizing several M. L. D. of toxic bacilli.

In discussing the significance of the observations reported, as well as those in the literature, the close resemblance between the organisms responsible for diphtheria and the Preisz-Nocard bacilli is discussed. It is thought that any knowledge available on the treatment of diphtheria carriers can be applied to the treatment of ulcerative lymphangitis. "As in diphtheria, it would probably be very advantageous to inject animals with an adequate dose of a good antitoxic serum as soon as cases can be diagnosed. In localities where numbers of cases are occurring it would be valuable to inject animals which are probably infected with the bacillus (as indicated by heat and swelling of a limb or limbs), but in which actual formation and bursting of abscesses has not occurred. Such early treatment may indeed be the essence of the whole problem, as cases might in this way be prevented from passing into the more intractable chronic or carrier state."

The agglutination reaction in the diagnosis of tuberculosis. W. P. LARSON, E. N. NELSON, and P. Y. CHANG (*Soc. Expt. Biol. and Med. Proc.*, 19 (1922), No. 7, pp. 359, 360).—To obtain homogeneous suspensions of tubercle bacilli for use in the agglutination test, the authors have employed the method

previously described by Larson, Hartzell, and Diehl (E. S. R., 38, p. 584) of subjecting the bacilli to carbon dioxide pressure for two or more hours, after which the emulsion is diluted to the desired standards with salt solution.

Johne's disease, a cattle menace, B. A. BEACH and E. G. HASTINGS (*Wisconsin Sta. Bul. 343* (1922), pp. 23, figs. 6).—This is a summary of the status of knowledge of Johne's disease based on investigations conducted by the authors in Wisconsin, an account of which has been noted from another source (E. S. R., 46, p. 682). Progress reports of work conducted have also been noted (E. S. R., 45, p. 284; 47, p. 482).

The problem of an unidentified hemorrhagic disease of cattle (*Nevada Sta. Rpt. 1921, pp. 15, 16*).—A brief reference is made to studies by E. Records and L. R. Vawter of the disease of cattle which occurs east of the Sierra Nevada Mountains, an account of which under the name ictero-hemoglobinuria has been noted (E. S. R., 46, p. 684). An investigation showed that there were no more coccidia present in diseased animals than in healthy ones. It was found impossible to reproduce the disease by an artificial inoculation of *Bacillus botulinus*. Artificial inoculation with the two common bacteria, *B. welchii* and *B. oedematiens*, which were found present nearly always in the livers and other parts of the diseased animals, caused a disease very closely resembling that occurring throughout western Nevada.

A note on the period of incubation in hog cholera, M. DORSET (*Jour. Amer. Vet. Med. Assoc., 61* (1922), No. 4, pp. 393-396).—Data furnished by W. B. Niles on the period of incubation in a limited number of pigs exposed to hog cholera are reported and discussed. The animals used were 171 shots varying from 50 to 70 lbs. in weight, obtained in the vicinity of Ames, Iowa, from susceptible stock not previously exposed to hog cholera. Each animal received an injection of 5 cc. of defibrinated virus blood subcutaneously in the loose tissue of the flank. Daily observations were made of temperature changes, first visible symptoms, and loss of appetite.

Considering the time of the appearance of visible symptoms as the end of the period of incubation, the shortest incubation period noted was three days, observed in 2.9 per cent of the cases, and the longest period was seven days in 1.75 per cent of the cases. In more than 95 per cent the incubation period ended on the fourth, fifth, or sixth days. The data reported are thought to indicate that a virus which after subcutaneous injection causes visible symptoms in any considerable proportion of the test animals before the fourth day is either of exceptional virulence or is contaminated.

"It is believed that hog-cholera virus which will produce visible symptoms and a rise in temperature in 50 per cent or more of susceptible pigs on the fourth day after subcutaneous injection, and which has the power to cause progressive disease so that a considerable majority of the pigs are 'off feed' on the fifth day, will produce good serum, will give a reliable serum test, and will result in a lasting immunity when properly administered with antihog-cholera serum. It is questionable whether a virus which does not, after subcutaneous injection, produce symptoms of disease in the great majority of susceptible pigs before the seventh day is fit for use in producing or testing serum or in administering the simultaneous treatment."

The common intestinal roundworm of swine (*Ascaris lumbricoides*), H. M. MARTIN (*Nebraska Sta. Circ. 17* (1922), pp. 11, figs. 3).—A summary of information on this parasite.

Control of bacillary white diarrhea, 1920-21, G. E. GAGE (*Massachusetts Sta. Control Ser. Bul. 18* (1922), pp. 8).—This is a report of control work conducted in continuation of that previously noted (E. S. R., 34, p. 387). Dur-

ing the season of 1920-21 blood serum from 24,718 birds was examined for indications of the specific agglutinins elaborated by *Bacterium pullorum*, of which 12.5 per cent reacted. The results, presented in tables, show (1) the geographical distribution of the various breeds tested during 1920-21, (2) the geographical distribution of the infection as determined by the testing work, (3) the distribution of infection among various breeds, (4) the classification of the sizes of flocks tested, (5) the number of flocks having certain limits of infection, and (6) the reduction of the percentage of infection as determined by testing work in 15 different flocks selected as representing accomplishment in elimination in heavily infected flocks. Certain changes in the certification of stock are recommended.

RURAL ENGINEERING.

The design and construction of dams, E. WEGMANN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, 7. ed., rev. and enl., pp. XVII+555, pls. 163, figs. 232*).—This is the seventh revised and enlarged edition of this book. It deals with masonry, earth, rock fill, timber, and steel structures, and with the principal types of movable dams. It contains chapters on distribution of pressure in a wall of masonry; theoretical and practical profiles; construction; Spanish and French dams; dams in various other parts of Europe, Algiers, Egypt, Asia, and Australasia; American dams; reinforced concrete, earthen, rock-fill, timber, steel, frame, and shutter dams; dams made by the hydraulic process; dams with bear-trap gates; stony roller sluice gates, rolling dams, butterfly dams, etc.; cofferdams; overflow weirs; and crest gates and siphon spillways.

The measurement of water, W. G. STEWARD (*Idaho Sta. Bul. 127 (1922), pp. 3-32, figs. 19*).—This is a handbook of practical information and working data for ditch riders and water users.

Studies of water from the glaciers of Argentière and Bossons, D'ARSONVAL, BORDAS, and TOUPLAIN (*Compt. Rend. Acad. Sci. [Paris], 174 (1922), No. 23, pp. 1443-1446*).—Chemical studies of samples of water from two Alpine glaciers are briefly reported and discussed. These indicated the marked variability in the general mineralization of the water with particular reference to the magnesium content. It is thought possible to determine something of the geological nature of the soils covered by glaciers by physico-chemical analyses of the glacier waters. The variation in the composition of these waters was much greater than is found in ordinary waters.

A source of lead contamination of cistern water, L. GREENBURG (*Pub. Health Rpts. [U. S.], 37 (1922), No. 30, pp. 1825-1829*).—This is a report of an examination of the drinking water supply system at the U. S. Fish Hatchery Station, at Gloucester, Mass., for possible sources of lead contamination, in which it was found that the flashing on the roof of the hatchery building, from which rain water is collected and then used for drinking purposes, is the source of the lead found in the water under investigation.

Preservative treatment of farm timbers (*Iowa Sta. Rpt. 1921, pp. 48, 49*).—The progress results of studies on the preservative treatment of fence posts are briefly presented (E. S. R., 46, p. 383). These are said to demonstrate the fact that quick-growing, nondurable Iowa woods can be successfully used for fence-post purposes after having been treated with creosote, and that durable fence-post woods, such as white cedar, can be made to last for a long period of years with little deterioration after creosote treatment. The general results secured from a number of experimental fence lines which have been used for a period of 16 years indicate that after this period of time woods such

as white cedar show little deterioration of the creosoted portions. The experiments, especially with willow posts, have demonstrated quite conclusively that the tops should be treated as well as the bottoms.

Motor road transport for commercial purposes, J. PHILLIMORE (*London: Isaac Pitman & Sons, Ltd. [1921], pp. XIV+212, pls. 30, figs. 7*).—This book is intended as a guide for those who propose to adopt mechanical traction and transport for the first time, and is written from the English viewpoint. It contains chapters on motor road transport—past and present; advantages of motor transport used commercially; the scope of the motor in country districts; selection of a vehicle; drivers and driving; the cheapest forms of mechanical road transport; petrol vehicle running costs at 2–20 cwt., 25–50 cwt., and 3–10 ton loads; electric vehicles and running costs (3–10 tons); trailers; passenger-carrying types of vehicles; considerations in the organization of a motor service and the need of keeping records; what records to keep; how to keep account of costs; interest on capital expenditure and depreciation, with specimen tables; insurance and its costs; running cost items; fuel, spare parts, tires, lubricants, garage organization; bonus systems; economies—fuel; bodies—rapid loading and unloading devices; electric trucks and the cost of running; an example of big fleet organization; and clearing houses.

Report on the motor tractor trials organized by the Ministry of Agriculture, A. T. MCKILLOP (*Cairo: Egypt Min. Agr., 1921, pp. 55, pls. 26*).—The results of two different sets of motor tractor trials conducted on medium soil of the southern Delta and on heavy soil of the northern Delta regions in Egypt are presented and discussed. Thirty different tractors were tested, among which were a number of American manufacture. A striking feature of the results was that apparently on the soils of Egypt the so-called caterpillar type of tractor is not so efficient as the wheel-driven type. The highest all-round efficiencies were given by wheel-type tractors, and the best all-round results by a 20 h. p. machine. Considerable detailed data of results of operation are presented.

Detonation characteristics of some blended motor fuels, T. MIDGLEY, JR., and T. A. BOYD (*Jour. Soc. Automotive Engin., 10 (1922), No. 6, pp. 451–456, figs. 5*).—Studies of the detonating tendencies of mixtures of some of the principal materials that are used as components of the blended motor fuels now available commercially are reported, special attention being paid to the effects of admixtures of various percentages of alcohol and alcohol-benzene mixtures for reducing the detonating tendency of paraffin hydrocarbons. The bouncing-pin apparatus was used for making the determinations. In order that the effects of the blending materials might be measured through as wide a range as practicable, they were blended with kerosene for making the majority of the determinations.

It was found that the presence of only a small percentage of an aromatic hydrocarbon in a paraffin fuel has but a slight effect toward suppressing detonation. This is in agreement with the previous observations on benzol-gasoline blends that the addition of less than 20 per cent of benzol to a commercial gasoline or a naphtha exerts only a small influence toward causing the engine to give smoother operation. When benzol was blended with paraffin fuels in larger percentages, its effect increased rapidly as its concentration relative to the paraffin fuel was raised. Toluene on the basis of volume was more effective than benzene for eliminating detonation conditions, and xylene was in turn still more effective than toluene for the purpose.

It was observed that the addition of 1 per cent of xylidine to a fuel that gives incipient detonation in a certain engine made it possible to raise the compression of the engine about 10 lbs. without any greater detonation being

obtained than with the untreated fuel at the original and lower compression. On the volume basis, alcohol was considerably more effective than benzol for the suppression of detonation when blended with a paraffin fuel. It was found that 35 per cent of alcohol blended with kerosene produced an effect in suppressing the detonating tendency of the fuel equal to that given by 55 per cent of benzol blended with the same material.

The results further indicated that the detonating tendency of a fuel composed of two ingredients is greater than the average of the values representing the detonating tendencies of the two components taken separately.

[*Farm machinery studies at the Iowa Station*] (*Iowa Sta. Rpt. 1921, pp. 8, 9*).—Tests of commercial limestone spreaders and a study of the various methods of handling limestone are said to have shown that the desirable features of a limestone spreader are, (1) it should be able to handle either wet or dry stone, (2) it should be arranged to pass stones without injury to the machine, and (3) it should spread uniformly and be calibrated with reasonable accuracy. The most desirable type of spreader would be in the form of a trailer behind a loaded wagon, the material being shoveled directly from the wagon to the spreader. None of the machines tested fully met these requirements.

A comparative study of the work and merits of round and cutaway blades for disk harrows showed that the cutaway blade causes from 10 to 20 per cent heavier draft and penetrates more deeply than the round blade. It also tends to tear out chunks of soil rather than to loosen the entire surface. It is difficult to sharpen, and it is more easily broken than the round blade.

An extensive study of the influence of speed upon the draft of various types of plows showed that the type of plow bottom does not materially influence the draft, and an increase in speed will produce about the same increase in draft with any type of bottom. The increase in draft due to speed is confined to that part of the total which is required for turning and pulverizing. This varies with the speed from less than one-third to about one-half of the total draft of the plow within a speed range of from 2 to 4 miles per hour. Variation in depth is considered to be probably the greatest source of error in plow tests of a comparative nature. Under some conditions of plowing a sharp cutting edge has been found to be of little importance, and high speeds may cause failure to scour.

The results of a trial of a mechanical silage packer are also briefly presented.

Draft investigations of farm machinery (*Nebraska Sta. Rpt. 1922, pp. 23, 24*).—The results of a large number of plow tests made under varying depths and speeds are said to vary widely in the case of speed draft tests, but are fairly consistent for the depth draft test. The increase in draft due to increase in depth from 5 to 10 in. was approximately 27 per cent of the draft at 5 in.

Tests to determine the draft of a disk harrow for different angles of the disk section and the effect of weight on the draft showed that the increase in draft due to fully angling the sections was about 175 per cent of the draft at no angle. The increase in draft due to weighting the disk with a weight of 180 lbs. was 60 per cent of the no-weight draft.

Electric power for milking plants, L. BRIMS (*New Zeal. Jour. Agr., 23 (1921), No. 2, pp. 99-103, figs. 2*).—The results of a series of meter tests made on five typical milking plants in the Canterbury District of New Zealand are reported and discussed.

While a 3 h. p. motor was employed in each case, the tests indicated that a 2 h. p. motor would be sufficient for at least four out of the five and probably, with a little improvement in the conditions of operation, for the fifth as well.

This is considered important from the economic standpoint, as the idle magnetizing current for a 8 h. p. motor would be approximately 50 per cent greater than for a 2 h. p. motor, and this magnetizing current must be supplied continuously as long as the motor is running, whether loaded or not. The power used was found to be very variable and apparently depends much more on the efficiency of the plant and the method of use than on the actual number of cows milked. A record of the power consumption of four of the plants for 12 consecutive months is also presented.

The opinion is expressed that the most effective application of electric power to milking machine work under New Zealand conditions will consist of a small self-contained outfit comprising an electric motor, vacuum pump, cream separator, small water supply pump, and a 10-gal. water cistern with the necessary switch gear, all mounted on a compact hardwood base plate.

It is considered probable that if more consideration were given to proper alignment of machines and shafting and solidity of foundations a higher efficiency would be obtained, since the present tendency is to erect the plant in a lightly built shed attached to the cow stall, much to the detriment of the efficiency.

Harness repairing, L. M. ROEHL (*Milwaukee: Bruce Pub. Co., 1921, pp. 53, pl. 1, figs. 44*).—This is a popular handbook giving information on harness and harness repairing. It contains sections on making various repairs and repair tools, cleaning and oiling a harness, etc.

Making load tests of a tile wall and measuring floor deflections, E. GODFREY (*Engin. News-Rec., 89 (1922), No. 5, pp. 189, 190, figs. 3*).—Methods and apparatus for determining the influence of concentrated loads on tile walls and measuring floor deflections are described and illustrated.

Efficiency of various kinds of ventilating ducts, C. E. A. WINSLOW and L. GREENBURG (*Pub. Health Rpts. [U. S.], 37 (1922), No. 30, pp. 1829-1839, fig. 1*).—A study of the uniformity of air distribution attained with ventilating ducts of various designs is reported.

It was found that branch ducts gave better results than lateral ports. With either branch ducts or lateral ports, an untapered main duct gave better results than a tapered one. Other conditions being equal, plenum ventilation was more even than exhaust ventilation. The most important factor determined was the use of slanting branch ducts for the exhaust or discharge of air into or from the main duct. Where such lateral branches were provided the shape of the main duct made little difference, as in all the tests made with such branches in operation results were obtained showing an average deviation of less than 5 per cent.

If lateral-branch ducts are not provided, it is concluded that the design of the main duct becomes of compelling importance. A tapered main duct with lateral ports gave a distribution so markedly uneven as to detract in a serious measure from its efficiency, whereas the lateral port system, though never so good as one which involves the use of branch ducts, may yield results which are fairly satisfactory if the main duct is untapered.

It is stated in conclusion that in order to secure the most even distribution, ventilating systems on either the plenum or exhaust plan should be constructed with slanting branch ducts, and the question whether the main duct should be tapered or untapered should be decided by the relative cost of labor and materials involved. Reasonably good distribution can be economically effected with an untapered duct discharging or exhausting through lateral ports. A tapered duct discharging or exhausting through lateral ports is likely to give rise to serious irregularity in distribution.

Poultry housing for Pennsylvania, T. B. CHARLES (*Penn. State Col. Ext. Circ. 91 (1922), pp. 24, pl. 1, figs. 17*).—Practical information on poultry houses

adapted to Pennsylvania conditions is presented, together with detail and working drawings, specifications, and bills of materials.

Pitcher pump installation, E. G. WELCH and J. B. KELLEY (*Ky. Agr. Col. Ext. Circ. 125 (1922)*, pp. 4, fig. 1).—This circular briefly describes and illustrates a pitcher pump installation for water supply, adapted to conditions on Kentucky farms.

The farm septic tank, J. C. WOOLEY, W. M. GIBBS, and R. B. GRAY (*Idaho Sta. Bul. 128 (1922)*, pp. 3-18, figs. 12).—The purpose of this bulletin is to describe in a general way the bacterial action of a septic tank and to give in detail the method of its construction and operation. In a discussion of the changes taking place in the materials which enter a septic tank, it is stated that "all these materials driven into the septic tank are easily cared for by the bacteria and changed to simple harmless materials. They enter as a dirty, greasy mixture and leave in a simple and sanitary form. The tank may be placed as near the house as desired because there is no odor from it. The out-flowing stream, or effluent, may be run into an open field because it contains only completely decomposed substances and is not insanitary."

RURAL ECONOMICS AND SOCIOLOGY.

The business of farming in some of its larger aspects, T. N. CARVER (*Ill. Univ. Bul., 19 (1922)*, No. 31, pp. 91-100).—It is held that farmers are weak in bargaining power and will be until Europe resumes normal production with consequent demands for American farm products. The effect on land values of fluctuations in agricultural prosperity is said to be very great, and the buying of land on credit hazardous. It is held that a system of farm accounting should be followed in order that the farmer may know whether or not his farm is paying expenses, including a salary for management.

The effect of variations in prices upon costs of production and financial results, J. WYLLIE (*Scot. Jour. Agr., 5 (1922)*, No. 3, pp. 250-261).—It is pointed out that relative rather than absolute increases or decreases in costs of production must be taken into account, and also that a variation in the price of a certain commodity will affect one class of farmers more than another and one district more than another.

Estimated percentage decreases in various items of cost of milk production for 1921-22 are worked out for 32 Scottish farms; and comparing these with actual costs for the year ended May 14, 1921, and counting on a 5 per cent decrease in milk production, a final result of a 14 per cent decrease in the gross farm cost of milk production is reached. A decrease of 31 per cent in the cost of horse labor on 1921 crops is estimated. A summary of the average per acre costs of potatoes and oats in 1920 is similarly drawn up, in comparison with estimated increases or decreases in 1921, assuming the same conditions regarding weather, size of crops, etc. It indicates reductions of 12 per cent for oats and 19 per cent for potatoes.

The effects of variations in price upon the net results of farming are further illustrated from financial accounts of 61 farms scattered throughout Scotland. Of these, 29 were mixed dairying lowland farms, while 27 were lowland and 5 hill sheep farms. In a given system of farming, a 10 per cent decrease in the selling prices of cattle and sheep would have practically the same effect upon the net results as a 40 per cent decrease in the prices of crops or of live stock products, while a reduction of 1 per cent in the selling prices of cattle and sheep would be equivalent to a 40 per cent reduction in the price of wool. As for different systems of farming, a 10 per cent reduction in the selling prices of cattle and sheep is much more important to the mixed nondairying or hill sheep farmer than to the milk selling farmer. The stock rearing and hill sheep

farmers may be practically indifferent to variations in the selling prices of crops. It is intended to show that low crop and fat stock prices are not a reason for changing the system of farming, unless they are low relative to prices for milk and cheese; that hill sheep farming is a stable system, while mixed dairying is more elastic; and that the percentage of each item of cost will vary from year to year.

Labor requirements of Arkansas crops (*Arkansas Sta. Bul. 181 (1922), pp. 9-12, figs. 2*).—In work conducted by A. D. McNair in cooperation with the U. S. Department of Agriculture, two charts of a total of 51 noted as having been completed are presented here to illustrate the investigation of the utilization of land and labor on important crops of Arkansas. The first of these shows the average labor requirements of 10 acres of cotton in Chicot County; and the second, of 10 acres of grapes in Washington County, Ark. It is attempted to bring out the relationship between the utilization of land and labor and cost of production.

Land prices and land speculation in the bluegrass region of Kentucky, G. W. FORSTER (*Kentucky Sta. Bul. 240 (1922), pp. 39-74, figs. 4*).—The basic material for this bulletin was obtained from answers to questions asked of buyers and sellers of farm land. Records of 1,146 land transfers were obtained, 1,086 of which were sufficiently complete to supply these data. Information on net rents from farm lands were obtained from 150 landlords who rent their farms on a cash, share, or share-cash basis. Additional data concerning farm income were obtained by survey on 52 farms, and data on the cost of, and income from, tobacco were procured from a bulletin previously noted (*E. S. R., 45, p. 42*). The area studied included Bourbon, Clark, Fayette, Jessamine, Madison, Scott, and Woodford Counties.

The rise of land prices in Kentucky is found to have been similar to, although not quite as marked as, the general rise for the United States as a whole. From 1850 to 1890 the average increased from \$9.15 to \$16.17 per acre. For the period 1900 to 1920, the increase was \$43.01, or 247 per cent. In the seven counties covered by this investigation, land prices increased from \$34.09 per acre in 1850 to \$53.26 in 1890, reaching \$200.25 per acre by 1920.

Considerable evidence is shown of activity in buying and selling farm land.

A classification is made of 721 purchasers and 512 sellers according to whether they became owners through tenancy or directly. Out of the total number of purchasers, 13.8 per cent were tenants who were buying land for the first time. Of 86 living on farms, 74 were buying for the purpose of production. On the whole it does not appear that tenants were becoming land-owning farmers at a rate which could be considered encouraging. Farmers as a class were found to have been less active in speculative purchases than nonfarmers. That the majority of purchasers were buying for purposes of production is substantiated by the fact that 61.67 per cent of 940 purchasers stated that they intended to use the farm for production. Of the 791 farms purchased by farmers, 62.3 per cent were purchased for the purpose of production.

Certain factors influencing the price of land are discussed, including earnings from farm lands, the influence of tobacco prices, inflation of the currency, land speculation, and miscellaneous causes.

It is not attempted to indicate conclusively the effects of the recent activity in land transactions in this region. Data were gathered, however, regarding 146 persons, all of whom were in financial difficulties. Thirty-eight of this number voluntarily deeded back the farm to the former owner, thus incurring cash losses which averaged \$9,356. Of these 146 cases, 44.5 per cent represented buyers who were being given extensions of time. A few purchasers were trying

in vain to sell their farms. It is believed that the solution of the present difficulties lies in the utilization of existing credit agencies rather than in the establishment of a new system.

Local land tenure, I. M. NOOR (*Malayan Agr. Jour.*, 10 (1922), No. 1, pp. 13-17).—Salient facts regarding titles, conditions of landholding, and rent payment in the Straits Settlement and the Federated Malay States are outlined.

Land and labor in a Deccan village, H. H. MANN and N. V. KANITKAR (*London and Bombay: Humphrey Milford, Oxford Univ. Press*, 1921, pp. VII+182, pla. 5).—Study No. 2 was made in a village twice the size of that covered by an earlier one (E. S. R., 43, p. 293.) It is located 25 miles away from Poona, so that it is not influenced by the labor demands of the industrial center and is in an area of smaller and more uncertain rainfall. The method and scope of this survey is similar to the earlier one.

It appears that out of 147 families investigated only 22, or less than 15 per cent, can pay their way in the standard which they have themselves fixed. The others are either living below that standard, deriving some income from the outside, or increasing their debts. It is reaffirmed that the dry villages of the Deccan are in very unsatisfactory economic condition.

The small-holdings colony of the Women's Farm and Garden Association at Lingfield, Surrey, England, A. VANDERPANT (*Farm and Garden [Chicago]*, 10 (1922), No. 4, pp. 10, 15).—A farm of 93 acres has been divided into six holdings occupied by 12 women. This note briefly relates the two years' history of the colony.

Wages of farm labor, C. L. HOLMES (*Minnesota Sta. Tech. Bul.* 4 (1922), pp. 3-65, figs. 12).—An analysis of the wages of hired farm labor in Minnesota is made, involving comparisons by sections of the State and by systems of farming and the tracing of changes in wage levels. The data used were taken from crop reporters' estimates, State census returns of 1920, and answers to a special inquiry as to wages for all types of contracts and the value of the board and other nonmoney payments included in the hired man's total wage, as submitted by 1,500 farmers concerning over 2,500 hired men. Six sections of the State are described from the point of view of types of agriculture and their effect on the labor problem.

Of the 2,508 hired men reported, 1,300 were engaged by the month and 1,208 by the day. Of the month men, those hired for the season are most numerous, followed by those hired for the year. Of the day men, those hired for work in harvesting and caring for crops are 50 per cent more numerous than those engaged for other work. The number of day contracts reported is greater than that of month contracts in sections devoted to small grain crops, truck crops, and small scale farming. In sections given to live stock farming and types of cropping which accompany it and where larger farms and farm business are the rule, there is an excess of month contracts over day contracts.

A marked tendency is shown toward a definite wage level. The averages from the sample data on wages of men hired for the season show month wages to be highest where the type of agriculture is based on corn, live stock, and small grain; next highest in the small grain area, where natural conditions are not quite so favorable; and next in dairying sections. The regional variations in wages seem to bear a closer relation to the relative profitableness of farming and the size of the farm business unit than to any other factors. Day wages are highest in sections where the small grains harvest requires a large amount of labor during the latter part of the season. It is indicated that wages are normally higher in the newer portions of the country, especially the prairie regions, than in the older and better developed portions.

It is shown that with the exception of farm machinery the increase in the price of labor prior to the late war was less than for any other item. Fur-

thermore, it is indicated that while the price of land almost trebled between 1880 and 1910, wages increased only 75 per cent and the rates of labor to land remained about constant. Although the price of machinery remained about constant during the period, the amount used per laborer and per acre nearly doubled. While the price of horses was doubled, the number used increased only one-third in relation to labor and decreased one-third in relation to machinery. In spite of a 75 per cent increase in wages, each farmer was managing, in addition to his own labor, two-thirds of a hired man in 1910, as compared with one-third of a hired man in 1880.

The nature and causes of the farm-labor shortage are discussed at length.

The average percentage of increase in Minnesota farm expense as based on labor and machinery costs, 1915-1920, and average farm prices of the more important agricultural products in the same period are presented graphically, indicating that during 1916 and 1917 the prices of products were increasing much more rapidly than the expense, while in 1918 and 1919 expenses were increasing more rapidly than the prices of products but not rapidly enough to eliminate profits. In 1920, however, losses were very heavy, and many farmers refused to pay the high wages asked in the spring. It is obvious that the limitations on quick expansion and contraction of the farmer's business affect his bidding for labor.

The farm bureau, E. T. ROBBINS (*Ill. Univ. Bul.*, 19 (1922), No. 31, pp. 71-78).—The history, purposes, and activities of the Illinois Farm Bureau are outlined.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets*, 2 (1922), Nos. 6, pp. 105-120, figs. 3; 7, pp. 121-152, figs. 4; 8, pp. 153-168, figs. 2; 9, pp. 169-192, figs. 3).—The usual temperature and precipitation charts for each week for the four weeks ended August 22, with notes on weather conditions, are presented, together with tabulated weekly reports on prices and receipts in the market of important agricultural commodities and special articles on local or outstanding market situations and foreign markets. The current monthly crop report, including tabulated summaries of crop conditions and the usual estimated farm value of important products and averages of prices received by producers, appears in No. 7. A special article in No. 8 is a summary of reports on crop prospects in Russia up to about July 1. In No. 9 is found a review of boll-weevil damage to cotton through 13 years, in which it is indicated that that of 1921 has not been exceeded in any previous year. Other special articles in these numbers relate to market prospects for and shipments of specific commodities.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul.*, 9 (1922), No. 54, pp. 8, fig. 1).—A brief note on the returns to North Carolina woolgrowers as a result of their recent wool pool is given in this number, together with the usual partial list of products which farmers have for sale.

Rural community organization, A. W. HAYES (*Chicago: Univ. Press*, 1921, pp. XI+128, pls. 2, figs. 3).—Attempting to define the proper local unit which lends itself to comprehensive community organization, the author discusses the small rural school district and other types of communities, including the rural parish, the township unit, New England towns, the country community of the South, and the North Carolina incorporated communities. It is declared that "upon the basis of the consolidated school district as a unit of organization, which can well cover every part of the farm population, the farmer may easily find himself and identify his relationships to every other group in the State and country at large." The results of a study of the community value of consolidated school districts in Randolph County, Ind., and in Marshall County, Iowa, are set forth. A compilation is made of information

as to the general trend of the consolidation movement in Colorado, North Dakota, Iowa, Illinois, and Oklahoma. A short bibliography is given. In the appendixes the text of the North Carolina community incorporation act is reproduced and maps are given of the counties noted.

Reading matter in Nebraska farm homes, J. O. RANKIN (*Nebraska Sta. Bul.* 180 (1922), pp. 28, figs. 9).—This is a summary of the results of a survey conducted by the station and the U. S. Department of Agriculture, cooperating. The reading matter found in 1,338 farm homes was studied.

It was found that farmers and town people get very similar reading matter, and that owners and tenants read practically the same kind of things. Periodicals were found to reach almost all Nebraska farms studied. Farm papers and newspapers furnish most of the reading matter. Women's magazines reach a fourth or a fifth of the homes, family or general magazines reach one-sixth, and children's magazines reach less than one home in every 33 studied. Books from libraries enter about one home in 20.

With regard to the sources of loans to farm homes, it is said that State commission traveling libraries are cheapest, but leave many needs unsupplied. County library systems render the promptest and best service. Book and magazine clubs help, but more libraries are needed.

A short bibliography on rural libraries is included.

AGRICULTURAL EDUCATION.

The work of the college of agriculture, F. H. RANKIN (*Ill. Univ. Bul.*, 19 (1922), No. 31, pp. 46-55).—The history of the Illinois College and Experiment Station and its contribution to the development of agricultural teaching are set forth here.

The work of the agricultural experiment station, L. H. SMITH (*Ill. Univ. Bul.*, 19 (1922), No. 31, pp. 37-45).—This reviews briefly the work of the Illinois Experiment Station and its outstanding accomplishments during the 34 years of its existence.

Economic phases of farming, W. F. HANDSCHIN (*Ill. Univ. Bul.*, 19 (1922), No. 31, pp. 161-169).—Some problems of adjustment, including the teaching of collective marketing of farm products, improving the skill in management of operators of small farms, standardization of farm practice in given regions, and a few land problems, are outlined from the point of view of the rôle of the agricultural college and experiment station.

The position of higher education in agronomy in the group of advanced studies, É. MARCHAL (*Acad. Roy. Belg., Bul. Cl. Sci.*, 1921, No. 12, pp. 785-806).—New legislation reorganizing the system of higher agricultural education for Belgium as embodied in the law of November 15, 1919, and the royal decrees of April 8 and August 14, 1920, is discussed in these pages. In general outline this new organization may be said to consist of two higher State institutes of agronomy, one at Gembloux for French students and the other at Ghent for Flemings, and an independent institute of agronomy at the University of Louvain. A four years' degree course is required. The first two years are devoted to general scientific preparation, the last two to specialization. The following lines of specialization are possible: The agriculture of temperate regions, colonial agriculture, rivers and forests, horticulture, agricultural chemistry, and rural life.

The organization and direction of clothing clubs, H. M. PHILLIPS and F. MALLOY (*Illinois Sta. Circ.* 263 (1922), pp. 3-30, figs. 7).—This contains in detail the information deemed necessary for organizing club groups and directing the work of junior and senior clothing projects. Projects for three years

each of junior and senior work have been outlined. Lists of books on clothing and of literature available from the Illinois junior extension service are given.

The elementary course in genetics, C. B. HUTCHISON (*Science*, n. ser., 55 (1922), No. 1425, pp. 416-421).—This paper, which was read during the 1921 meeting of the American Association for the Advancement of Science, gives the author's opinion of the scope and relations of an elementary course in genetics to an agricultural course. A complete outline of the elementary course in genetics as given at Cornell University is presented.

The field problem in the soils course, A. B. BEAUMONT (*Jour. Amer. Soc. Agron.*, 14 (1922), No. 3, pp. 79-88).—The directions given to vocational agricultural students in a two years' course at the Massachusetts Agricultural College for carrying out an assigned problem in soil management and making their reports, also the directions drawn up for more advanced students, are presented here.

A manual of agriculture for Morocco, B. SANS (*Manuel d'Agriculture Marocaine*. Paris: Delagrave, 1922, pp. 168, figs. 58).—This volume presents elementary principles of agriculture and live stock production for use as a manual in teaching children.

MISCELLANEOUS.

Farm helps from experiments, B. KNAPP (*Arkansas Sta. Bul.* 181 (1922), pp. 103, figs. 35).—This contains the organization list, brief summaries of the chief lines of work of the station during the fiscal years ended June 30, 1921, and June 30, 1922, and a financial statement for the latter fiscal year. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Annual Report of Idaho Station, 1921, E. J. IDDINGS (*Idaho Sta. Bul.* 129 (1922), pp. 15).—This contains the organization list, a report of the director, and financial statements for the Federal funds for the fiscal year ended June 30, 1921, and for the remaining funds for the fiscal year ended December 31, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Iowa Station, 1921, C. F. CURTISS and P. E. BROWN (*Iowa Sta. Rpt.* 1921, pp. 64).—This contains the organization list and a report on the work of the station, including a financial statement for the fiscal year ended June 30, 1921. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Nebraska Station, 1921, E. A. BURNETT and W. W. BURR (*Nebraska Sta. Rpt.* 1921, pp. 58).—This contains the organization list, a report of the work of the station, a report of the extension service of the college of agriculture, and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Nevada Station, 1921, S. B. DOTEN (*Nevada Sta. Rpt.* 1921, pp. 20, figs. 2).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, and a report of the director discussing the work and problems of the station during the year. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Rhode Island Station, 1921, B. L. HARTWELL (*Rhode Island Sta. Rpt.* 1921, pp. 13).—This report by the director includes experimental work for the most part abstracted elsewhere in this issue.

NOTES.

Georgia College.—H. C. Appleton has been appointed field crop specialist for the agronomy extension work, beginning December 1.

Iowa Station.—The station barn was completely burned October 8, causing an estimated loss of \$25,000. Practically all the live stock was saved, but there was a considerable loss of seed and farm equipment.

Kentucky Station.—J. S. Yankey, inspector in the department of entomology and botany has been succeeded by Max Braithwait, and J. B. Nelson, assistant chemist in the public service laboratories, by Lloyd Meader. Miss Ethel L. Hopphan has been appointed assistant bacteriologist.

Tennessee University.—O. M. Watson, associate professor of horticulture, resigned November 1 to engage in commercial work and has been succeeded by N. D. Peacock, field agent of the Tennessee State Horticultural Association.

Officers of the Association of Land-Grant Colleges.—The complete list of general officers elected at the Washington meeting noted editorially in this issue is as follows: President, Howard Edwards of Rhode Island; vice president, E. A. Burnett of Nebraska; secretary-treasurer, J. L. Hills of Vermont; and members of the executive committee, R. A. Pearson of Iowa, chairman; W. M. Riggs of South Carolina, A. F. Woods of Maryland, A. R. Mann of New York, and F. B. Mumford of Missouri.

For the various sections the officers are as follows: Agriculture, C. F. Curtiss of Iowa, chairman; R. L. Watts of Pennsylvania, vice chairman; and B. H. Crocheron of California, secretary; engineering, H. S. Boardman of Maine, chairman, and C. R. Jones of West Virginia, secretary; and home economics, Flora Rose of New York, chairman, and Stella Palmer of Arkansas, secretary. In the three subdivisions of the section of agriculture J. H. Skinner of Indiana and A. R. Mann were chosen chairman and secretary, respectively, for that of resident teaching; W. R. Dodson of Louisiana and J. W. Wilson, chairman and secretary for that of experiment station work; and C. F. Monroe of New Mexico and H. C. Ramsower of Ohio for extension work.

The changes in the standing committees were unusually numerous. On the committee on instruction in agriculture, home economics, and mechanic arts, R. A. Seaton of Kansas succeeded F. E. Turneure of Wisconsin for a three-year term, Nellie Crooks of Tennessee replaced Mary E. Sweeny of Michigan for two years, and W. C. Coffey of Minnesota and O. M. Leland of Iowa succeeded A. B. Cordley of Oregon and A. A. Potter of Indiana for one-year terms. W. M. Jardine of Kansas and L. D. Coffman of Minnesota were succeeded on the committee on college organization and policy by Louise Stanley of Missouri and C. C. Little of Maine. The vacancy on the committee on organization and policy occasioned by the retirement of Dean Davenport was filled by the appointment of T. P. Cooper of Kentucky, and F. D. Farrell of Kansas replaced F. B. Linfield of Montana for a three-year term. T. O. Walton of Texas succeeded R. S. Wilson of Mississippi on the committee on extension organization and policy, H. A. Morgan of Tennessee and E. G. Peterson of Utah replaced W. E. Johnson of South Dakota and F. L. McVey of Kentucky on that of military organization and policy, and M. S. Ketcham succeeded A. A. Potter of Indiana on that of engineering experiment stations. E. D. Ball, E. W. Allen, and W. A. Taylor have been named as the representatives of this Department on the joint committee on projects and correlation of research.

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EXPERIMENT STATION RECORD.

VOL. 47.

ABSTRACT NUMBER.

No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Standard methods of chemical analysis, edited by W. W. SCOTT (*New York: D. Van Nostrand Co., 1922, 3. ed., rev. and enl., vols. 1, pp. XXVIII+714, pls. 3, figs. 95; 2, pp. XVII+1003-1567+50, pls. 2, figs. 168*).—In this revision of the volume previously noted (E. S. R., 37, p. 310), the amount of new material has necessitated the rearrangement of the subject matter in two volumes, the first of which includes the material in parts 1 and 3, and the second that of part 2 of the original text, with the addition of several new chapters.

The popular chemical dictionary, C. T. KINGZETT (*London: Baillière, Tindall & Cox, 1921, 2. ed., pp. VIII+539, figs. 16*).—A revision of the volume previously noted (E. S. R., 45, p. 108).

Moisture absorptive power of different sugars and carbohydrates under varying conditions of atmospheric humidity, C. A. BROWNE (*Jour. Indus. and Engin. Chem., 14 (1922), No. 8, pp. 712-714*).—A number of carbohydrates and commercial food products containing different sugars were tested for moisture absorptive power as follows: The substance was first dried in vacuo to constant weight in the presence of phosphorus pentoxid. About 1 gm. of the powdered material was then spread over the bottom of a weighing bottle provided with a ground glass stopper and exposed to the air for varying periods of time, after which the absorptive power for moisture was measured from the gain in weight. The results obtained with some of the more common substances are given in the following table:

Moisture absorbed from air by various materials at 20° C.

Anhydrous material.	60 per cent humidity, 1 hour.	60 per cent humidity, 9 days.	100 per cent humidity, 25 days.	Anhydrous material.	60 per cent humidity, 1 hour.	60 per cent humidity, 9 days.	100 per cent humidity, 25 days.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Starch.....	1.04	12.98	24.37	Commercial glucose.....	0.29	9.00	47.14
Cellulose.....	.89	5.37	12.57	Malt sirup.....	.28	8.84	50.96
Agar.....	.88	20.34	42.96	Levulose.....	.28	.63	73.39
Maltose.....	.80	6.97	18.35	Commercial invert sugar.....	.19	5.05	76.58
Lactose.....	.54	1.23	1.38	Pure invert sugar.....	.16	3.00	73.95
Molasses.....	.46	9.86	68.92	Dextrose.....	.07	.07	14.50
Honey.....	.44	10.00	74.10	Sucrose.....	.04	.03	18.35

After an exposure for 25 days to 100 per cent humidity the substances were allowed to stand under ordinary atmospheric conditions until equilibrium had been reached. All of the products listed in the above table lost moisture except lactose, which continued to show a slight gain for several months. Sucrose continued to lose moisture during a period of two years. Although the absorptive power of the substances studied was highest in periods of high humidity and lowest in periods of low humidity, no fixed relationship could be established between percentage humidity and moisture content.

A knowledge of the moisture absorptive power of sugars and carbohydrates is considered of practical importance in determining the best methods of preparing sugars in the most stable form, in determining legal standards of moisture in certain carbohydrates and food products, in selecting materials to prevent the drying out of food products such as cake, and in considering the question of the retention of moisture by the growing parts of plants during germination or in periods of drought.

A quantitative study of the adsorption in solution and at interfaces of **sugars, dextrin, starch, gum arabic, and egg albumin, and the mechanism of their action as emulsifying agents**, G. L. CLARK and W. A. MANN (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 157-182).—To determine what are the properties essential for an emulsifying agent or colloid protector, and what kind of a nonelectrolyte is best for different purposes, quantitative measurements were made of surface tension, interfacial tension, and viscosity of solutions of sugars, dextrin, starch, gum arabic, and egg albumin alone and in the presence of different electrolytes. A study of actual emulsions was also made of each of the substances alone and in the presence of electrolytes.

With sugar, viscosity appeared to be the factor of chief importance in producing emulsions, and ability to lower the interfacial tension of next importance. The inversion of sucrose was found to be accompanied by a slight increase in surface tension, but invert sugar proved no more efficient than sucrose in holding up suspensoids.

The conclusions of Herzfeld and Klinger (*E. S. R.*, 45, p. 203), that dextrin is simply a more highly dispersed starch, were confirmed. Dextrin proved to be a better emulsifying agent than starch, chiefly by the lowering of interfacial tension brought about by the smaller size of the particles.

The efficiency of gum arabic as an emulsifying agent is attributed to the lowering of interfacial tension and viscosity, and that of egg albumin to the adsorption of film formation.

It is concluded that no one general rule can be made as to the effect which produces the best emulsions for all substances under all conditions, but that film formation is of primary importance in all cases.

The preparation of fructose, T. S. HARDING (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 8, pp. 1765-1768).—A method is described for the preparation of fructose by fractional crystallization from invert sugar obtained by the hydrolysis of sucrose by invertase, the greater part of the glucose being first removed by crystallization from the concentrated invert sirup after the addition of glacial acetic acid. The final yield of fructose after recrystallization from alcohol is from 14 to 18 per cent of the weight of the original sucrose.

Contribution to the knowledge of the glycerids of fats and oils.—X, **The glycerids of goose fat**, A. BÖMER and H. MEERTEN (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 43 (1922), No. 1-4, pp. 101-137).—Goose fat was found to contain 3.8 per cent of stearic acid, 21.2 per cent of palmitic acid, and 72.3 per cent of oleic acid. The following glycerids were identified: A very small amount of difficultly soluble glycerid, β -palmitodistearin, from 3 to 4 per cent of stero-

dipalmitin, 5 per cent of dioleostearin, 30 per cent of dioleopalmitin, and 45 per cent of triolein.

Certain tropical oil seeds, E. R. BOLTON and D. G. HEWER (*Analyst*, 47 (1922), No. 556, pp. 282-284).—Brief descriptions are given of six tropical oil-bearing seeds, together with a table of the analytical constants of the oils obtained from these seeds. The seeds examined include bacury kernels, the seed of *Platonia insignis*, the oil of which is suitable for candle and soap making; andirobinha or mapia seeds from Brazil, the oil of which can be used for soap making; bey beans, a species of *Baillonella*, the oil of which after suitable refining is said to be suitable for edible purposes; two types of *Parinari* seeds known as pajura and jaboty, the first of which yields a drying oil and the second a firm yellow fat which is thought to be edible; and two species of *Theobroma*, *T. grandifolia* and *T. bicolor*, which are closely related to the ordinary cocoa bean.

The constants of Indian beeswax, O. D. ROBERTS and H. T. ISLIP (*Analyst*, 47 (1922), No. 555, pp. 246-251).—The analytical constants are given of the purified wax obtained from 23 samples of honeycomb or crude wax collected from different districts in India.

The use of phenol red as an indicator for milk and sugar media, H. C. BROWN (*Lancet* [London], 1922, I, No. 17, pp. 842, 843).—The use of phenol red in place of litmus in the preparation of milk and sugar media is recommended, and the technique for preparing phenol red milk with condensed milk is described. The phenol red media are considered superior to litmus media in their sensitiveness to small differences in reaction.

McIntosh and Fildes method for attaining surface growth of obligate anaerobes, W. S. GOCHENOUR (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 3, pp. 301-304, fig. 1).—A simple apparatus for the McIntosh and Fildes method of surface cultivation of anaerobes by removal of oxygen with a palladium catalyzer is described and illustrated.

The influence of various antiseptics on the activity of lipase, L. S. PALMER (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 7, pp. 1527-1528).—The effect of different concentrations of several antiseptics on the activity of lipase was tested by determining the H-ion concentration of emulsions of milk fat in gum acacia solutions after 24 hours' incubation with commercial steapsin as the source of lipase.

Formaldehyde in concentrations up to 1 part in 250 had no effect on the activity of the lipase, 1 per cent solutions being required to retard its activity. Chloroform in concentrations of from 1.5 to 2.5 per cent caused a retardation in lipase activity of from 20 to 60 per cent, acetone in concentrations of 6 and 12 per cent of from 12 to 25 per cent, and a freshly prepared 3 per cent solution of iodoform in acetone of from 25 to 40 per cent. Complete inhibition of lipase activity was obtained with a solution of iodoform which had stood for some time. Iodoform was found to retard lipase activity in direct proportion to its concentration, varying from a 15 per cent retardation with 0.03 per cent concentration to a 55 per cent retardation with 0.5 per cent concentration. Iodin and bromin inhibited lipolysis, the former to a greater extent than the latter. The data are thought to indicate the possibility of an unsaturated aliphatic structure for the lipase molecule.

A method of quantitative determination of trypsin, S. KAI (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 133-136).—A modification of the method of determining trypsin, reported by Gross (*E. S. R.*, 19, p. 910), is described. This consists essentially in comparing the time necessary for the trypsin being tested to digest a certain concentration of casein to a point at which no turbidity is

formed when a mixture of sodium hydroxid and acetic acid of a certain concentration is added, with the time required for a known standard trypsin to digest the same concentration of the casein under identical conditions.

New methods for the determination of potassium and ammonium, O. ARRHENIUS (*Meddel. K. Vetensk. Akad. Nobelinst.*, 4 (1920), No. 6, pp. 5, fig. 1).—The method for determining small amounts of potassium in soil solution involves the use of Billmann's sodium cobaltic nitrite reagent (E. S. R., 12, p. 516). The soil solution, which should contain from 0.1 to 5 mg. of potassium, is freed from all metals except sodium, made up to 15 cc., acidified with about 5 cc. of glacial acetic acid, cooled to about 0° C., and treated with 5 cc. of freshly prepared 10 per cent sodium cobaltic nitrite. The precipitate is allowed to settle in the cold for about 12 hours, after which most of the clear solution is decanted off and the precipitate transferred to centrifuge tubes with capillary stems, the final precipitate being washed into the tubes with a little of the mother liquid. The tubes are then centrifuged, and the height of the precipitate is read by a scale on a mirror and compared with the results obtained from solutions of potassium chlorid of known concentration.

For ammonia determinations in soil analysis, the authors recommend the Folin aeration method with the addition of a concentrated solution of sodium sulphate to prevent the adsorption of the ammonia.

A method for the estimation of small quantities of calcium, P. P. LAIDLAW and W. W. PAYNE (*Biochem. Jour.*, 16 (1922), No. 4, pp. 494-498).—The method described, which is said to be applicable to the determination of less than 1 mg. of calcium, is essentially as follows:

The calcium is first separated as the oxalate and then converted into crystalline calcium alizarinate. This is collected and washed on a Gooch filter and decomposed by oxalic acid. The alizarin thus obtained is dissolved in alcohol, made up to a known volume with a large volume of dilute ammonia, and compared in a Duboscq colorimeter with a standard solution of ammonium alizarinate. The method is said to be accurate on 0.1 to 0.002 mg.

A colorimetric method for the determination of small amounts of magnesium, F. S. HAMMETT and E. T. ADAMS (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 211-215, figs. 2).—The method consists in the precipitation of magnesium as ammonium magnesium phosphate according to the method of Kramer and Tisdall (E. S. R., 46, p. 416), and the subsequent colorimetric determination by the method for phosphorus of Bell and Doisy (E. S. R., 44, p. 613). The combined method is said to be applicable to the estimation of small amounts of magnesium in urine, blood, and tissue extract.

The composition of commercial phosphoric acid, W. H. ROSS, C. B. DURGIN, and R. M. JONES (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 553-555).—Simple and accurate methods for the determination of the inorganic constituents of commercial phosphoric acid are outlined, and tabulated results are given showing the composition of different samples of phosphate.

Kellogg's sampling horn, J. W. KELLOGG (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 7, p. 631, fig. 1).—A description is given, with illustration, of a new type of sampling horn for obtaining samples of feeding stuffs and fertilizers. The horn, which is made of $\frac{1}{8}$ -in. brass tubing, consists of two sections, the total length of which when joined is 31.5 in. The upper section has a 4-in. handle securely fastened, and the lower section a ferrule into which the upper section is screwed when in use. The lower end of this section consists of a beveled sharpened knife-edge point protected, when not in use, with a slip-on cap. The tube is provided with slots or openings $\frac{1}{8}$ in. in width, designed especially for removing the sample with a spatula.

A practical guide for food analysts and chemical inspectors, M. LEPRINCE and R. LÉCOQ (*Guide Pratique d'Analyses Alimentaires et d'Expertises Chimiques Usuelles*. Paris: Vigot Bros., 1921, pp. XVI+760, pl. 1, figs. 104).—This laboratory manual consists of methods which were adopted at the laboratory of military analysts of the fifth region, France, during the World War. The subject matter includes sections on analytical methods for feeding stuffs, fertilizers, and water; food adjuvants including beverages, spices, flavoring extracts, condiments, and mushrooms; edible oils and fats, lubricating oils, soaps and bleaching agents, and waxes; fermented and distilled beverages; and foods.

The conversion of macro methods in food chemistry into half micro or micro methods, H. LÜHRIG (*Pharm. Zentralhalle*, 63 (1922), Nos. 16, pp. 218–221; 17, pp. 27–232).—The results are reported of attempts to adapt the usual methods of determining the constants of fat to micro determinations, using much smaller amounts of the fat and the various reagents.

It was found possible to obtain satisfactory results in the Reichert-Meissl determination with the use of as small an amount as 0.05 gm. of butter fat, but for practical micro determinations 0.5 gm. is considered a better amount. Fairly satisfactory results were obtained in determinations of the Polenske number with 0.5 gm. of the sample. Determinations of the saponification number (Köttsdorf) gave good results with 0.15 gm. For the iodine number better results were obtained with the Hanus than with the Hübl method.

The technique and apparatus for the various tests are described in full.

A method for the colorimetric estimation of carnosin, W. M. CLIFFORD (*Biochem. Jour.*, 15 (1921), No. 3, pp. 400–406).—The colorimetric method of Koessler and Hanke¹ for estimating iminazole derivatives has been applied with certain modifications to the determination of carnosin in muscle extracts. The method consists essentially in precipitating the proteins from the extract with *m*-phosphoric acid, neutralizing an aliquot portion of the filtrate with 10 per cent sodium hydroxide with litmus as indicator, diazotizing given portions of the solution as in the original method, and comparing in a Duboscq colorimeter against a standard containing 0.0001 gm. of carnosin, repeating the comparison with different amounts until an exact match is obtained.

On some new color reactions of cholesterol, L. KAELENBERG (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 217–225).—In the course of an investigation of the function of cholesterol in the animal body, the author has found that cholesterol is soluble in a number of anhydrous inorganic chlorides and bromides, the solutions generally being colorless. Several exceptions to this rule have been found to occur, the most interesting of which is the behavior with anhydrous arsenious chloride, AsCl₃. In this solvent brain cholesterol or gallstone cholesterol gives a pink solution, gradually turning to a bright cherry red; isocholesterol a cobalt-blue solution, changing to violet, purple, dark red, and dark green on standing; and phytosterol a colorless solution. These reactions thus enable one to distinguish between cholesterol, isocholesterol, and phytosterol.

The antiscorbutic vitamin.—I, **A study of its solubility from desiccated orange juice**, E. B. HART, H. STEENBOCK, and S. LEPKOVSKY (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 241–250, figs. 5).—A study of the solubility of the antiscorbutic vitamin of orange juice in various organic solvents is reported from the Wisconsin Experiment Station. The method employed in the greater part of the work consisted in desiccating 1,200 cc. of the orange juice at room temperature on 300 gm. of oatmeal and completing the drying in a desiccator over sulphuric acid for several days. The material was then extracted with

¹ *Jour. Biol. Chem.*, 39 (1919), No. 3, pp. 497–519.

2,000 cc. of the solvent being tested, the solvent filtered off by suction, the residue washed with the solvent, and this extraction repeated twice. The united extracts were then evaporated on 1 kg. of the scorbutic ration, which consisted of 69 parts of rolled oats, 25 parts of ground alfalfa hay, 5 parts of casein, and 1 part of salt. Guinea pigs, weighing from 200 to 400 gm., were used as the test animals, with 4 animals in each lot.

As thus tested the antiscorbutic vitamin of desiccated orange juice proved to be soluble in 80 and 95 per cent and absolute ethyl alcohol, and also in methyl alcohol. It was insoluble in butyl alcohol, benzene, petroleum ether, acetone, ether, chloroform, and ethyl acetate. "The behavior of this vitamin toward organic solvents and water indicates that it is not of fat or lipid character."

Method for determining hydrogen sulphid evolved by foods when cooked at various temperatures, E. F. KOHMAN (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 527-529, fig. 1).—An apparatus by means of which hydrogen sulphid evolved from foods cooked at 100° C. or over can be determined accurately is described.

The method involves the distillation of the product by pressure in a flask inclosed in an autoclave and the gravimetric determination of the sulphid as barium sulphate. The method is also applicable to the study of other volatile products evolved in the cooking of foods. The results obtained with this apparatus on samples of lye hominy are reported in a contribution previously noted (*E. S. R.*, 47, p. 718).

The results obtained by cooking 1,000 gm. of fresh corn in the canning stage in 500 cc. of water and collecting the distillate in one-half hour periods are reported, together with the results obtained showing the effect of alkalis and acids and of iron salts on the amount of hydrogen sulphid evolved by the green corn when heated. The data show that the amount of hydrogen sulphid evolved varies considerably for different lots of corn, that more is evolved during the first one-half hour than the second, and that the amount decreases for each succeeding period.

Detection and determination of substitutes in flour and bread, E. Voet (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 42 (1921), No. 7-8, pp. 145-173).—This is a report of an extensive investigation of microscopical and chemical methods of detecting the adulteration of wheat flour or bread with various substitutes, including barley, corn, oats, and various forms of potato flour.

For the microscopic detection of these substitutes the author recommends a differential coloring with a dilute solution of Congo red in India ink. The microscopic detection of steamed potato flour is impossible on account of the change of the cells into a water-soluble formless mass. A quantitative determination of substitutes by the microscopical method is practically impossible.

The chemical detection of substitutes can be made through determination of the true alkalinity of the ash of the flour or bread, i. e., the alkalinity after deducting the alkalinity due to P_2O_5 . Data are presented on the true alkalinity of the ash of bread containing varying amounts of substitutes.

The valuation of lard, A. BÖMER (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 43 (1922), No. 1-4, pp. 87-101, fig. 1).—This is a discussion of the author's methods of detecting adulteration of lard (*E. S. R.*, 32, p. 801).

The determination of benzoic acid in margarin, O. KÖRKE and E. BONLÄNDER (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 43 (1922), No. 10, pp. 345-350).—A method for the quantitative determination of benzoic acid in margarin is described as follows:

Of the well-mixed sample 50 gm. is placed in a wide-mouth flask provided with a ground glass stopper, 100 cc. of $N/10$ sodium carbonate solution is added,

the stopper is loosely inserted in the flask, and the flask is heated on a water bath at 600° C. until the margarin is melted, after which the flask is shaken thoroughly for two minutes, the stopper being removed at intervals. The fat is then allowed to harden, the liquid drawn off, and filtered through dry paper, and 75 cc. of the filtrate transferred to a 100 cc. graduate flask containing about a gram of pure ammonium sulphate. The flask is shaken and allowed to stand for one-half hour, to dissolve the ammonium sulphate completely, after which the volume is made up to 100 cc. and the liquid filtered into a dry flask. Of the filtrate, 80 cc. is acidified in a separatory funnel with 3 cc. of dilute sulphuric acid and shaken five times with 40 cc. of a mixture of equal parts of ether and petroleum ether.

The ether extracts are brought together in another separatory funnel, washed three times with 5 cc. of water, and transferred to a wide-mouth flask containing some pieces of pumice. The solution is distilled slowly, and the last part is allowed to evaporate at room temperature. The residue is taken up with water and, after the addition of two drops of phenolphthalein solution, titrated with N/10 base to a deep red color, heated to boiling, titrated with N/10 hydrochloric acid until the color disappears, and then again with N/10 base until the red color reappears.

In making the final calculation of the amount of benzoic acid the predetermined water content of the margarin must be taken into consideration.

The theobromin content of cacao beans and cocoa, R. V. WADSWORTH (*Analyst*, 47 (1922), No. 553, pp. 152-161).—The results are reported of determinations, by the method previously noted (E. S. R., 45, p. 413), of the theobromin content of unroasted and roasted cacao nibs and shells from various sources and of commercial cocoas. Moisture and fat determinations are also included.

The maximum variations found in the nibs or shelled unroasted beans of all types and grades were between 0.99 and 1.69 per cent of theobromin on the original nib and between 2.22 and 3.82 per cent on the dry fat-free material. The differences are considered to be due to the variety and to the amount of fermentation, fermented beans in general being lower in theobromin content than unfermented. The shells on the contrary were found to have a much higher content of theobromin when fermented than unfermented. The maximum variations observed were between 0.19 and 2.98 per cent. The germs separated commercially from a blend of roasted cacao bean had a theobromin content of 2.1 per cent of the original material or 2.23 per cent of the fat-free substance.

As judged by the analysis of three varieties of beans before and after roasting, there is practically no loss of theobromin on roasting. In the case of the shells, however, there proved to be an increase in the theobromin content of shells having an initially high content and a decrease in those of low theobromin content.

The manufactured cocoas examined had a content of between 2 and 2.3 per cent of theobromin on the original cocoa and between 3 and 3.6 per cent on the dry fat-free material.

The detection of apple juice in so-called pure fruit preserves, C. F. MUTTELET (*Ann. Falsif.*, 15 (1922), No. 164, pp. 196-200).—The addition of apple juice to other fruit juices, such as currant or raspberry, in the making of jellies results in the lowering of the acidity of the preparation and the introduction of malic acid. To detect the presence of apple juice in jellies, the author recommends the determination of the acidity of the product and of its content in malic acid, separated as barium malate.

Methods of analyzing artificial honey, particularly the determination of sucrose and glucose, A. BEHRE (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 43 (1922), No. 1-4, pp. 24-46).—Methods of analyzing artificial honey are discussed at length.

Formulas for the direct calculations of glucose and sucrose in fruit juices, marmalades, etc., A. RINCK (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 42 (1921), No. 12, pp. 372-382).—The derivation is given of three formulas by means of which the percentages of water-free glucose, water-containing glucose, and sucrose, respectively, can be determined in any sirup provided the content of extract in the sirup and the polarization values are known. The formulas are as follows:

$$\text{Water-free glucose} = \frac{\text{Extract} \times 0.43 + \text{polarization}}{0.311}$$

$$\text{Water-containing glucose} = \frac{\text{Extract} \times 0.43 + \text{polarization}}{0.255}$$

$$\text{Percentage of sucrose} = \frac{\text{Extract} \times 2.682 - \text{polarization}}{0.311}$$

Relative sweetness of invert sugar, J. W. SALE and W. W. SKINNER (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 522-525).—As judged by careful tasting experiments at the Bureau of Chemistry, U. S. D. A., invert sugar solutions, prepared by the hydrolysis of sucrose with N/2 hydrochloric acid, tartaric acid, and autolyzed yeasts, were of equal sweetness, but less sweet than a sucrose solution of the same concentration. If an arbitrary value of 100 is assigned to sugar, the invert sugar equals 85, or 117 units of invert sugar have the same sweetening power as 100 units of sucrose.

The sugar sirups inverted with hydrochloric acid and tartaric acid were practically without color and flavor, but gave a rather harsh sensation on tasting. The sirup inverted with invertase and concentrated by boiling under reduced pressure was practically colorless, possessed only a slight flavor, and was smooth to the taste. Bottled soda made with invert sirups which were practically without flavor and color proved satisfactory, but those made with invert sugar prepared according to the usual formulas or processes had a slight candy flavor and were not satisfactory. The keeping quality of bottled drinks prepared with invertase solutions was satisfactory.

Results of some vinegar investigations, C. H. HUNT (*Amer. Food Jour.*, 17 (1922), No. 9, pp. 11, 12).—A study is reported from the Ohio Experiment Station of the vinegar-making properties of juice from western apples grown in irrigated and nonirrigated orchards. Determinations of the chemical constants of samples representing several thousand gallons of fresh juice showed no appreciable difference in composition. The constants of the vinegar prepared from the juice of apples grown under irrigation were similar to those of the juice of nonirrigated apples and also came within the minimum and maximum figures of the U. S. D. A. standards. The addition of yeast to hasten fermentation proved to be without advantage.

Manufacture of white potato flour, W. A. NOEL (*Chem. Age [New York]*, 30 (1922), No. 9, pp. 381-384, figs. 2).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of a description, with illustrative diagrams, of a model plant for the manufacture of white potato flour; chemical analyses, including ash constituents, of fresh potatoes and of potato flour prepared in different ways; and estimates of the manufacturing and production cost of potato flour based on prices prevailing in 1919. In the plant described the potatoes are first washed, then peeled, sorted, cooked, macerated, dehydrated, ground, bolted, and packed.

Comparison of wood cellulose and cotton cellulose, S. A. MAHOOD and D. E. CABLE (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 8, pp. 727-731).—In connection with a study at the U. S. Forest Products Laboratory, Madison, Wis., of the preparation of wood cellulose suitable to be employed as a substitute for cotton cellulose in the manufacture of cellulose esters, comparisons were made of wood and cotton celluloses varying in purity from the original raw materials to severely cooked and highly bleached samples. The data presented show that the wood cellulose most nearly corresponding to cotton is obtained by recocking "easy bleaching" sulphite pulp with soda and bleaching with 2 per cent bleach.

"On the basis of data given, cellulose from wood and cellulose from cotton do not represent identical chemical aggregates, and the same is true of wood cellulose obtained by acid cooking and by alkaline cooking. The practice of checking wood cellulose according to the specifications for cotton is therefore a questionable procedure."

METEOROLOGY.

The weather and the crops in eastern England, 1885-1921, R. H. HOOKER (*Quart. Jour. Roy. Met. Soc. [London]*, 48 (1922), No. 202, pp. 115-138, figs. 3).—In a paper previously noted (E. S. R., 19, p. 414) the author reported a study of correlation of weather and crops in this region based on the 21 years' data then available. This article gives the results of a study by the same methods of data covering a period of 35 years. The yields of wheat, barley, oats, beans, peas, potatoes, turnips, mangels, and hay are correlated with rainfall and temperature. The results are embodied in a series of diagrams which show the type of weather required for each crop throughout the period. The general results of the later study are similar to those reported in the earlier paper, although on the whole the earlier figures are as a rule somewhat toned down, the largest coefficients being often somewhat reduced.

Distribution of abaca in Cavite Province as related to soil and climate, P. S. ROJALES (*Philippine Agr.*, 9 (1921), No. 8-9, pp. 219-232; *abs. in Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 12, pp. 1514, 1515).—Of three prevailing types of climate in this Province of the Philippine Islands, the one most favorable to the growth of *Musa textilis* is characterized by a total annual rainfall of 2,766 mm. (108.9 in.), heaviest in November-February and lightest in March-June, with no dry season; a total humidity of 78 to 88 per cent, with slight variations; and an average temperature of less than 27° C. (80.6° F.). Analyses of soils of the Province, classified with reference to yield of abaca, indicate that the growth is directly related to the organic matter content of the soil.

Moisture content of peach buds in relation to temperature evaluation, E. S. JOHNSTON (*Bul. Amer. Met. Soc.*, 3 (1922), No. 9, p. 132).—"Marked increases in the moisture content of fruit buds of the peach have been noted during late winter and early spring. The rate of such increases after January 1 varies as the sum of the effective daily mean temperatures above 43° F. Although the factor of proportionality is a constant for any one year, it may vary for different years. Certain conditioning influences that are operative during or preceding dormancy apparently 'predetermine' the exact relationship between air temperature and the moisture content of the buds for the periods following dormancy."

Monsoon and trade winds as rain makers and desert makers, A. MCADIE (*Geogr. Rev.*, 12 (1922), No. 3, pp. 412-419, figs. 4).—The author reviews especially an article by G. C. Simpson on the causes and characteristics of the

southwest monsoon of India,¹ and discusses monsoonal influences on rainfall on the California coast, with the enunciation of certain laws which control the rainfall and determine the occurrence of droughts and the formation of deserts in that region. These laws are as follows:

“(A) When the continental high [hyperbar] overlies Oregon, Idaho, Utah, and Nevada, the general drift of the surface air is from the north or northeast, and such a circulation favors fair weather, with little precipitation. . . . Individual lows are restricted to northern counties and pass eastward without extending southward.

“(B) When the north Pacific low area (the Aleutian low [infrabar]) extends well southward along the Oregon coast and the continental high overlies Assiniboia [now Saskatchewan] and Montana, the general drift of the surface air in California is from the south or southeast. Conditions (then) favor unsettled weather, with frequent heavy rains west of the Sierra and heavy snowfall in the Sierra. Individual highs appear with little warning north and east of the Kootenai and move, as a rule, slowly south. Individual lows appearing over Vancouver Island and the north coast of Washington deepen and also extend southward, the rain area reaching northern California in 12 hours, the central coast in 24 hours, and the coast south of Point Conception in 36 hours.” . . .

“(C) A dry period in winter on the coast of California is caused by a deflection of the wind from southwest or south to west or northwest, due primarily to a retrogression of the Aleutian infrabar. Such winds blow parallel to the coast, have traversed but a short distance, and are moving from colder to warmer regions. The mountains of California can not act as efficient condensers. Conversely, heavy and frequent rains are due to long-distance air streams impinging as southwest winds on the coast, . . . [in which case] the Coast Range, the Sierra, and the Cascades can . . . act energetically as rain makers, for a moderate uplift of the air streams gives sufficient cooling to produce generous rain.”

The occurrence in California of dry periods in the midst of the rainy season, which long baffled explanation, “is now seen to be due to an interruption of the circuit of the air stream over the ocean. This happens when air surges southward from the Yukon. Usually the flow is southeast and on the inner side of the Siskiyou and the Coast Ranges; but occasionally the polar front bulges southwest and the ocean winds are forced seaward. At such times heavy snow falls on the immediate coasts of Washington and Oregon; but California for the most part is dry.”

Measurement of precipitation, B. C. KADEL (*U. S. Dept. Agr., Weather Bur., Instrument Div. Circ. E, 4 ed., rev. (1922), pp. IV+36, figs. 17*).—The instructions given in this circular for the measurement and registration of precipitation by means of the standard instruments of the U. S. Weather Bureau have been revised to date.

SOILS—FERTILIZERS.

Introduction to mineralogical soil analysis, F. STEINRIEDE (*Leipzig: Wilhelm Engelmann, 1921, 2. ed., rev. and enl., pp. VIII+240, figs. 106*).—This is the second revised and enlarged edition of this work. It deals particularly with the determination of the finer soil minerals by the use of the more recent petrographic investigational methods. It contains chapters on the history and importance of mineralogical soil investigation, obtaining soil samples by sedi-

¹ Quart. Jour. Roy. Met. Soc. [London], 47 (1921), No. 199, pp. 151–172, figs. 12.

mentation, methods of mineralogical investigation, procedure, tables for determining soil minerals, characterization of soil minerals, and a key for determining the important soil-forming minerals.

Experimental investigation on the water evaporation of naturally stratified soils, M. HELBIG and O. RÖSSLER (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 2, *Wiss.*, pp. 95-102).—Studies of water evaporation from naturally stratified soils subjected to air streams and of the conditions affecting it are reported.

It was found that evaporation follows the variations in the influencing factors slowly, so that maximum and minimum temperatures do not at the time mean the extremes of evaporation. Evaporation from differently cultivated and covered soils was almost the same at the time of the escape of the air. Evaporation was proportional to the saturation deficit only at the time of air escape, while variations were frequent at the time of air entrance. Evaporation was considerably less from naturally stratified soils than from artificial soils, especially at the time of air entrance. Cultivated strata lost less moisture by evaporation than uncultivated naturally stratified soils. The opposite was true when later the surface dried. A cover of living moss retarded and a cover of living rushes increased evaporation.

Soil survey of Logan County, Ky., L. R. SCHOENMANN, G. B. JONES, and S. D. AVERITT (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. 56, fig. 1, map 1).—This survey, prepared in cooperation with the Kentucky Experiment Station, deals with the soils of an area of 357,760 acres in southwestern Kentucky. The surface features vary from hilly in the northern and northwestern parts to gently rolling to level in other parts of the county. Drainage is said to be well established.

The soils of the county are grouped as upland and lowland or alluvial. The upland soils are residual from St. Louis limestone. Including rough stony land, 22 soil types of 12 series are mapped, of which the Decatur silt loam, Tilsit silt loam, and Decatur clay loam cover 24.9, 16.2, and 14.1 per cent of the area, respectively.

Further studies of alkali soils in Iraq, J. F. WEBSTER and R. VISWANATH (*[Mesopotamia] Dept. Agr. Mem* 5 (1921), pp. 46, pls. 5, fig. 1).—In a continuation of studies previously noted (*E. S. R.*, 46, p. 512), the action of various salts on the physical properties of the soil was first studied.

It was found that the presence of soluble salts materially affects the mechanical condition of the soil. Most of the salts commonly present flocculated the soil and increased its water-holding capacity. The rapidity of soil-water movements was also increased, but owing to the increased surface tension of the soil solution the range of the movements was not seriously diminished. These general results were not produced by sodium carbonate which, on the other hand, deflocculated the soil. Soluble salts increased the hygroscopic coefficient of the soil and thereby caused a serious loss in the moisture available for the plant. This loss outweighed any gain that accrued from diminished evaporation due to increased hygroscopicity.

Salts in soil solutions did not move in constant proportions when the soil water moved by capillarity or by percolation. Chlorids apparently moved more freely than either sulphates or carbonates. There appeared to be, however, a constant proportion of anions to cations, and in no case was translocation of salts accompanied by increased acidity or alkalinity. Owing to the diminution in the viscosity of the water, a rise in temperature increased the rapidity of water movements in spite of the decreased surface tensions which were thereby occasioned. This was true for salty as well as nonsalty soils.

"Although the minimum capillary capacity of water is no longer to be regarded as a critical amount but as an equilibrium point, it appears that this equilibrium point is of very great importance. The tendency of soils is to lose fairly rapidly, either by evaporation or by lateral or vertical transference to drier areas, water surplus to the minimum capillary requirements. Once this surplus has been lost, capillary movements cease and evaporation is checked by the formation of a layer at the surface which is no longer in capillary connection with the water below. The capillary water is the reservoir on which the plant feeds, and this water does not move to the plant but has to be collected by the plant root system."

Pot culture experiments were conducted to determine whether the studies of the effect of salts on the soil could be verified by experiments with growing plants. Tests of the wilting point of plants in salty soil and in soil from which the salt has been removed showed that wilting took place much more quickly in the salty soil than in the salt-free soil. It was also found that in every case plants which were germinated in a salt-free environment did better than those germinated in salty soil. The effect of removing the salt after germination was to improve the plant to some extent as compared with the control plants grown throughout in a salty soil, but they did not approach the size of the controls grown in salt-free soil. On the other hand, plants germinated in a salt-free soil were but little affected by the subsequent gradual addition of the salt. In no case did a plant germinated in a salty soil catch up in growth with plants germinated in salt-free soils.

In studies on the growth of seedlings under various conditions of salinity, but with a constant supply of nutrient salts, it was found that the early seedling stage is the one at which plants are the most readily affected by soluble salts. It was also shown that the check which a plant receives at this stage persists for a considerable period after the cause is removed.

The tolerance of wheat was studied for various salts, sodium chlorid being the most toxic, followed in order by calcium chlorid, magnesium chlorid, sodium sulphate, and magnesium sulphate. The limiting tolerances for these soils which will cause a plant to be so hindered in growth as to produce only one-half of its normal dry weight were found to be sodium chlorid from 0.2 to 0.3 per cent, calcium chlorid and magnesium chlorid from 0.3 to 0.4 per cent, sodium sulphate from 0.4 to 0.5 per cent, and magnesium sulphate from 0.9 to 1 per cent.

Studies of the osmotic pressure showed that there is a very close connection between the osmotic pressure that is exerted by salts in solution and the toxicity of such salts. In no case was sodium carbonate which was added to the soil entirely recoverable in the drainage waters. The organic matter of the soil was attacked by this salt, and as a result the water-holding capacity of the soil was seriously decreased, so that the toxicity of such soil as remained was correspondingly increased.

It is concluded that when the soil solution in a soil which has a moisture content equal to its minimum capillary capacity to a depth of 4 ft. has an osmotic pressure of more than 6 atmospheres, the soil may be considered too saline for ordinary agricultural purposes, especially for such crops as wheat and sorghum. Other practical aspects of the problem are discussed.

Effect of tree products on bacteriological activities in soils.—J. Ammonification and nitrification, W. M. GIBBS and C. H. WERKMAN (*Soil Sci.*, 13 (1922), No. 4, pp. 303-322, figs. 10).—Studies connected at the Idaho Experiment Station are reported, in which sawdusts from cedar, maple, ash, red fir, white fir, larch, white pine, and yellow pine were collected from kiln-dried

boards, carefully screened, and used in amounts varying from 1 to 3 per cent to determine the effect on ammonia accumulation from dried blood, nitrification of ammonium sulphate and dried blood, and nitrate reduction in forest soils. Other tree products, such as leaves, needles, and cones from the above-named trees, the so-called forest floor, and ferns, were similarly tested. The soils used were a timber soil of low fertility, a field soil of average fertility, and a garden soil of high fertility.

The various tree products tested proved inhibitory to ammonia and nitrate accumulation in the three different soils. Calcium carbonate did not overcome the inhibiting action of the various materials tested but caused a general increase in the nitrate formation. Cedar sawdust was the most inhibitory of the sawdusts to ammonia accumulation from blood. The reduction in the timber soil was 78.9 per cent, while white pine, the least inhibitory of the sawdusts, caused a reduction of 13.1 per cent. Cedar, maple, larch, ash, and red fir sawdusts had the greatest inhibiting action upon nitrate formation from ammonium sulphate and blood. Among the materials other than sawdust, white fir, yellow pine, and cedar needles caused the greatest reductions in the nitrification of ammonium sulphate. The indiscriminate collection of material covering the soil under the forest, or forest floor, reduced ammonia and nitrate accumulation in soils. Ferns, common on cut-over soils, proved but slightly inhibitory and therefore of no economic importance.

Denitrification experiments indicated that the reduction of nitrate formation is not due to the denitrifying group but to actual inhibition of the nitrifying organisms. Maple, and possibly ash, are exceptions in this respect.

The results of this study are taken to indicate that the low fertility and apparent toxic condition of Helmer silt loam in Idaho is in large part due to the timber residue. This material collects continuously throughout the growing period of the forest, and due to its slow rate of decomposition has a direct effect upon the beneficial biological processes in the soil. It is thought that a period of from 3 to 5 years is required for this timber residue to completely decompose and its detrimental action to disappear. The use of sawdust bedding is discouraged in case the sawdust is to be spread with the manure on the field.

The decomposition of organic nitrogen compounds of forest humus by biological processes. H. SÜCHTING, A. ROMER' and M. KÜHNE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 3, Wiss., pp. 113-154).—Several vegetation experiments to determine the extent to which acid pine forest humus will decompose and yield available nitrogen to plants under cultural conditions are reported. The humus was used with and without lime and excessively limed.

The lightly limed humus produced an approximately normal growth of oats, but the heavily limed humus caused a marked injury which was even greater in the case of rape. Further studies led to the conclusion that the nitrogen compounds of the pine forest humus are actually extremely insoluble. No evidence was obtained of the existence of injurious substances in the humus. Where the humus was reinforced with nitrogen in the form of urea and inoculated to promote nitrification, normal crops resulted. However, no decomposition of the insoluble nitrogen compounds of the humus took place.

The conclusion is drawn that forest humus will permit the biological decomposition of soluble organic nitrogen compounds in acid or neutral conditions. On the other hand, the organic nitrogen compounds of the humus under the same conditions are not capable of being decomposed to any appreciable extent

in the presence of easily assimilable carbohydrates. The final conclusion is that humus must contain great quantities of insoluble nitrogen compounds.

Soil management for fall seeded grains, M. M. McCool and G. M. GRANTHAM (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 5-7, figs. 2).—Practical information on the management of soils for fall seeded grains, with particular reference to conditions in Michigan, is presented. Proper cultural methods and adequate fertilizer applications are considered to be profitable. Where possible it is considered advisable to plow land early for fall grains, especially wheat. This results in a better seed bed and in the destruction of weeds.

Questions of experimental technique in fertilizer studies, KLEBERGER (*Landw. Vers. Sta.*, 99 (1922), No. 2-3, pp. 162-172).—Attention is drawn to the possibility that discrepancies found in the results of similar fertilizer studies may be due to variations in the sand used in pot studies. In this connection studies of different sands are briefly reported, which showed that washed river sand, for instance, is quite variable and very heterogeneous in chemical composition. It was also found that under certain conditions washed pit sand may develop a distinctly acid reaction. In view of these facts it is considered advisable in many cases to use a pure unwashed raw sand of known standard composition and reaction for pot tests rather than a washed, neutralized, and fertilized sand.

Further studies showed considerable nonuniformity in the grain sizes of river and pit sands. It is considered advisable to separate the sand used in pot studies into standard proportions of fixed sizes. The best results have been obtained with a mixture of 33 per cent of sand with grains over 3 mm in size, 33 per cent with grains over 1 mm, 28 per cent with grains over 0.5 mm, and 6 per cent of pure washed quartz.

Procedure in the actual conduct of plat tests is also discussed.

What the Delaware Experiment Station is doing along soil fertility lines, C. A. McCUE (*Amer. Fert.*, 57 (1922), No. 2, pp. 23-25, 56, 58).—A brief résumé of the soils and fertilizer work in progress at this station is presented. It is noted that in the fertilizer studies, complete fertilizer treatments and treatments of barnyard manure at the rate of 10 tons per acre have produced the largest yields of corn, wheat, soy beans, and hay. The majority of the soils of the State are said to be more or less deficient in humus, and the use of cover crops, preferably legumes, is considered generally desirable.

[Soil fertility studies at the Illinois Station] (*Illinois Sta. Rpt.* 1921, pp. 11, 12).—The results of fertility studies on the different soil types of 35 soil experiment fields obtained within the past 10 years, including 1921, are briefly summarized. Rather remarkable increases in crop yields are reported from the use of organic matter, limestone, and rock phosphate.

A continuation of studies with the Hopkins soil bins emphasized the great importance of soil variation as a factor affecting the reliability of plat experiments. It was found that the yield of wheat from different areas of a single bin on which the stand appeared especially uniform varied from less than 20 to more than 60 bu. per acre. Other studies have shown that sweet clover possesses a high sulphur content. It is stated that the high content of mineral plant nutrients found in this crop make it an important one for rendering nutrients available to succeeding crops.

In studies of methods of isolation and proving the purity of nodule bacteria, it has been found that the failure of nodule bacteria to inoculate may be due to a high moisture content, to acidity, or to oxygen starvation in the soil. *Bacillus radiobacter* may or may not kill the organism according to the cultural conditions maintained. The manner of storing soil for inoculation has been found to be a vital factor in the efficiency of the soil when used for inoculation.

How Greece can produce more food, C. G. HOPKINS (*Illinois Sta. Bul. 239* (1922), pp. 429-467, figs. 16).—This report presents the detailed results of studies made by the late Dr. Hopkins into the agricultural conditions existing in Greece, and recommends some practical scientific methods for improving these conditions. The results of the soil fertility studies included in this investigation have been previously reported by Bouyoucos (*E. S. R.*, 47, p. 121).

One of the striking recommendations made as the result of this investigation is that Greece establish as early as practicable a strong college of agriculture and an agricultural experiment station, and that the experiment station take up a detailed survey of the soils of Greece, including field experiments to determine the crop adaptations and the fertility requirements of the prevailing soil types. It is considered more important to investigate the value of phosphorus both in acid phosphate and in finely ground natural rock in connection with legume crops than to experiment with German or French potash or Chilean nitrate. A plan for conducting soil experiments is briefly presented and discussed.

It is further recommended that the Greek Government provide or issue an adequate supply at reasonable cost to farmers of acid phosphate and finely ground natural phosphate and assist in the introduction of suitable legumes and in the development of sources of pulverized limestone where needed.

Fertilizers (*India [Dept. Agr.] Rev. Operations, 1920-21, pp. 33, 34*).—Experiments on paddy manuring in Madras have shown that nitrogen and phosphorus increased the yield, while potash has, if anything, a depressing effect. The phosphatic manures, more especially the comparatively insoluble mineral phosphates, showed residual effects. Composting experiments with insoluble mineral phosphates showed that the maximum solution of the phosphates occurred after a week's composting, indicating very rapid fermentation.

Liming and manuring experiments at Jorhat in Assam, begun in 1909, indicated the value of basic manures and the beneficial effect of phosphoric acid, more particularly in its basic forms. The toxic effect of acid manures, such as ammonium sulphate, was also demonstrated.

In the Punjab green manuring was found to be successful in retaining moisture in light soils.

Forest fertilization questions, H. SECHTING (*Landw. Vers. Sta.*, 99 (1922), No. 2-3, pp. 173-190).—This is a strong argument for forest fertilization, or at least for studies tending to establish rational fertilization practices in forestry. Studies are briefly reported showing that raw acid pine forest humus has practically no value as a source of available nitrogen and can not be considered a source of fertilizer nitrogen for forests.

Soil cultivation and fertilization from the standpoint of supplying the plant with carbon dioxide as the most important agricultural raw material, H. KASERER (*Arb. Deut. Landw. Gesell. Österr.*, No. 9 (1921), pp. 3-14).—In a lengthy discussion of the importance of carbon dioxide production in soil to plant growth, the conclusion is drawn that moisture, light, and carbon dioxide are the most important factors affecting the prosperity of green plants. Cultural and fertilization practices favoring carbon dioxide production in soil are described. Experiments with potatoes and oats showed that an intimate mixture of nitrogenous fertilizers and stable manure gave much better yields than either fertilizer used alone.

Manure: Its value and use on Washington farms, F. J. SIEVERS (*Wash. State Col. Ext. Bul. 83* (1922), pp. 19, figs. 6).—Practical information on the conservation and use of barnyard manure on Washington farms is presented.

The effect of lime and manure on the improvement of Kirkland upland subsoils (*Oklahoma Sta. Rpt. 1921, pp. 8, 9*).—A continuation of studies on

the effect of lime and organic matter on the root systems in the so-called hardpan subsoils of the Kirkland series (E. S. R., 45, p. 422) as compared with the more friable subsoils of the Vernon and Yuhola series is said to have shown that lime increased the activity of the ammonifying and nitrifying bacteria, but that lime and organic matter caused a much greater increase. The plats receiving the manure had the highest moisture content. Practically all of the carbon found was organic carbon. Extra root development was caused by applications of lime and manure. A penetration test made of the soil in the field by using a steel cone with a trip hammer showed that organic matter and lime had reduced the resistance to penetration. Organic matter and lime increased the moisture-holding capacity in the first foot, and lime increased that in the second foot.

Necessity and action of fertilization with artificial fertilizers in addition to stable manure, GERLACH (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 2, *Wirtschaft.-Prakt.*, pp. 72-85).—The results of studies at four German experiment stations on the effect of the addition of commercial fertilizers to different soils receiving also stable manure are summarized and discussed.

Greater crop increases were produced when nitrogen salts were added with the stable manure than where potash and phosphoric acid were added, although all three increased yields. Potash gave good results in some cases, and in others the increases produced were small. On some soils the use of phosphoric acid were superfluous. No definite results were obtained with lime.

Home mixing of fertilizers, J. B. R. DICKEY (*Penn. State Col. Ext. Leaflet* 11 (1922), pp. 4).—Practical information on the home mixing of fertilizers, with particular reference to Pennsylvania conditions, is presented.

Nitrogen fertilization on nitrogen-gathering crops, F. AEREBØE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 4, *Wirtschaft.-Prakt.*, pp. 145-152).—Studies on the use of nitrogenous fertilizers on legume crops are reported. Regular heavy nitrogen fertilization to legumes, especially lucerne and red clover, increased the crops and produced feed with a higher protein content.

Nitrogen fertilization of pastures, J. HANSEN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 2, *Wirtschaft.-Prakt.*, pp. 49-72).—Studies of the influence of fertilization of pastures on the quantity and fat content of the milk given by cows feeding thereon and on the live weight of the cows are reported.

Fertilization of pastures caused a marked increase in milk production and a small increase in fat content. Potash and phosphoric acid fertilization caused increases, but these were much greater when ammonium sulphate was also added. Pasture fertilization had in general an opposite effect on the live weight of the animals, although this effect was quite variable. The decrease in live weight was quite marked where the pasture was fertilized with ammonium sulphate.

The results as a whole are taken to indicate the advisability of including nitrogen in the fertilization of pastures.

Fertilizer experiments with nitrogen and phosphoric acid in 1921, D. MEYER (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 4, *Wirtschaft.-Prakt.*, pp. 152-163).—Studies are reported, the results of which are taken to indicate that many German soils which received excessive phosphoric acid fertilization before the war do not need phosphoric acid fertilization at this time to produce normal crops as long as sufficient nitrogen and potash are added. It is estimated that many of these soils contain as much as 50 per cent of the phosphoric acid applied in 1913 in residual form.

The question of phosphoric acid fertilization, O. LEMMERMANN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 5, *Wirtschaft.-Prakt.*, pp. 201-232, pl. 1).—The author reviews work by himself and others bearing on the subject

to show that the productive value of phosphoric acid when in minimum in soil is greater than that of nitrogen, and that a small deficiency in phosphoric acid can cause more injury to crops than an equal deficiency in nitrogen. It is further pointed out that while legumes are better able to assimilate phosphoric acid from insoluble phosphates than nonlegumes, they do respond quite markedly in some cases to phosphoric acid fertilization. Nitrogen fertilization of legumes is concluded to be unnecessary in many cases and, while fertilization of meadows and pastures with nitrogen and potash can be profitably increased in many cases, such fertilization can not be wholly substituted for phosphoric acid fertilization. Many meadows and pastures have been found to require phosphoric acid.

With reference to the use of physiologically acid reacting fertilizers for the mobilization of soil phosphoric acid it is concluded that this can not be done without injury to the productiveness of the soil, since it is stated that most good agricultural soils in Germany already contain more soluble than insoluble phosphoric acid. It is pointed out that the main purpose of fertilization is to supply plant nutrients without injuring the physical condition of the soil or producing an unfavorable chemical reaction. An approximately neutral reaction is considered most desirable, and this is said to be incompatible with the extensive solution of soil phosphoric acid through the use of physiologically acid reacting fertilizers. The final conclusion is drawn that the best and safest way to meet a deficiency in phosphoric acid is by the use of artificial fertilizers.

The solution of phosphoric acid by plants and fertilizers, E. HASELHOFF (*Ztschr. Pflanzenernahr. u. Dungung*, 1 (1922), No. 6, *Wirtschaft.-Prakt.*, pp. 257-282).—The author describes a number of studies by himself and others bearing on the subject. These indicate that legumes are able to assimilate more phosphoric acid from insoluble phosphates and from soils containing insoluble phosphates than nonlegumes, and that considerable variation exists in the solubility of the phosphoric acid in different rocks.

Studies on the influence of nitrogen fertilization on soils containing insoluble phosphates showed that the nitrogen supply did not determine crop yield, nor explain why legumes assimilate more phosphoric acid from insoluble phosphates than nonlegumes. It was also found that where legumes were well supplied with nitrogen and potash and not with phosphoric acid a normal yield was not obtained. The addition of Thomas meal brought the yields to normal.

Experiments on heavy clay, clay shale, sandy loam, sand, and shale soils containing insoluble phosphates showed that nitrogen fertilization when used with proper combinations of other plant nutrients usually increased crop yields. Nitrogen-potash fertilization alone failed to produce normal crop yields, while favorable results were generally obtained with potash-phosphoric acid fertilization. Several other studies showed that the results of phosphoric acid fertilization vary according to the kind of soil, crop, and other growth factors.

Studies of the influence of nitrogenous fertilizers on the availability of raw phosphates showed that the influence of ammonium sulphate was quite favorable, while those of sodium and ammonium nitrates were of little importance. It was found that the availability of the phosphoric acid of Thomas meal could be considerably increased by mixing it with kainit.

The phosphate question in the present world industry, P. KRISCHE (*Ztschr. Angew. Chem.*, 35 (1922), No. 57, pp. 369-372).—A discussion is given of the phosphate resources of the world, together with a review of information, mainly from European sources, on the efficient utilization of phosphates in agriculture and on the conservation of available supplies.

The lime-potash law, P. EHRENBURG (*Ländw. Jahrb.*, 54 (1919), No. 1, pp. 159).—An extensive discussion of the subject is given, including up-to-date advice, to prevent mistakes in lime fertilization. Studies are also reported to explain the injurious action of large lime additions on plant growth. The basis of the lime-potash law is that where plants have only a small supply of available potash and the lime additions are increased, the assimilation of potash decreases, resulting in injury to the plant. This condition may be improved and in some cases entirely removed by heavy one-sided potash fertilization. It is advised that liming be not done without adding sufficient potash at the same time, with due consideration to the requirements and sensitiveness of the plant to both materials.

Experiments with electro-potash on wheat and buckwheat on different soils showed that caustic lime had a markedly injurious effect on both sandy and heavy soils. This injurious action was largely removed by heavy potash fertilization as far as the yield of dry matter was concerned. The decrease in yield of dry matter was found to accompany the decreased assimilation of potash due to excessive lime fertilization.

Experiments with by-product lime gave similar results, indicating that the injurious action of lime in reducing potash assimilation and yield in dry matter is not limited to burnt or caustic lime.

An extensive review of the literature is presented on the application of the lime-potash law in the growth of different crops.

Tests of soils for lime requirements, O. NOBLE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 5, *Wirtschaft.-Prakt.*, pp. 232-235).—Field tests of a soil weakly acid and one neutral by the Hasenbäumer lime requirement method showed that both soils responded markedly to lime treatment. The weakly acid soil gave additional crop increases when twice the amount of lime indicated by the Hasenbäumer method as required was used. It is concluded that field tests are best for determining lime requirements.

Liming the land in western Ohio, C. E. THORNE (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 7-8, pp. 106-111, fig. 1).—The results obtained from liming experiments at 14 experimental farms in Ohio are briefly summarized, indicating that on every one of the eastern Ohio farms lime is being very profitably used, while in the western half of the State the only farm that is paying for the liming is the Clermont County farm on the ancient loess soil. These results are taken to indicate that the older soils derived from sandstone or shale may be profitably limed, while soils derived from limestones or limestone gravel can not be expected to respond profitably to liming.

The importance of magnesia for plant growth, W. MAYER (*Jahrb. Halle-schen Verband. Erforsch. Mitteldeutsch. Bodenschätze*, 3 (1921), No. 2, pp. 61-73).—A discussion is given of the fertilizer value of magnesium and of the different natural and artificial combinations in which it may be applied to the soil. In experiments with potatoes, in the course of which so-called potassium magnesium sulphate and a mixture of potassium chlorid and kieserite were compared with other potassic fertilizers, greater crops and greater starch yields were obtained with the magnesium fertilizers, especially those containing no chlorine. The conclusion is drawn that the magnesium question is of sufficient importance to justify systematic study.

The scientific and practical importance of sulphur fertilization, B. HEINZE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 3, *Wiss.*, pp. 154-166).—A brief review of work bearing on the subject, done mostly in Europe, is presented.

The fertilizer value of activated sludge, W. D. HATFIELD (*Ill. Dept. Registr. and Ed., Div. State Water Survey Bul.* 16 (1920), pp. 91-139, figs. 8).—A series of studies of the fertilizer properties of activated sludge is reported,

In pot culture experiments in 1915 activated sludge was found to be superior to dried blood, gluten meal, and inorganic nitrogenous fertilizers when applied to sand. In garden experiments in the same year activated sludge produced a still larger increase in the growth of lettuce and radishes.

Pot experiments with three types of soil fertilized with septic tank sludge, Imhoff sludge, activated sludge, and dried blood showed that sewage sludge has a fertilizer value, and that the nitrogen of activated sludge gave better results than the nitrogen from the dried blood. Experiments on another type of soil showed the best results on sweet corn with 1.5 tons of activated sludge per acre. Garden experiments in 1916 showed an increase of 71 per cent in the weight of cucumbers due to activated sludge.

In sand cultures in 1917 applications of dried blood greater than from 0.5 to 0.75 ton per acre were toxic to wheat. Increasing the application of activated sludge on gray silt loam did not prove toxic to the growth of foliage, although in applications greater than from 1 to 2 tons it decreased the yield of grain.

The application of sewage sludges the second year to yellow silt loam did not prove toxic, but did not give as large a yield as was obtained the year before. The addition of phosphorus to white silt loam showed that phosphorus was the limiting element in this soil. Activated sludge was the only fertilizer which produced an increased yield.

Garden experiments in 1917 showed that both wet and dried activated sludges were valuable as fertilizers, the wet sludge giving the better results.

The nitrogen in activated sludge was found to be present mainly in the form of nucleo-protein nitrogen and its hydrolytic products. Pot culture experiments showed that sodium nucleinate is readily available to plants and that uric acid, while at first toxic, is nitrified or decomposed in time so that its nitrogen is also available. Egg albumin was highly toxic to young wheat plants, indicating that the intermediate hydrolytic products of albumin are toxic. Acidified activated sludge gave much better results than unacidified sludge.

Good results were obtained with dried blood if the applications were in amounts small enough so that the concentration of toxic substances was low.

Drying activated sludge on sand beds was found to be impracticable in the Illinois climate, and filter pressing under the available conditions was not successful. Excess aëration of the sludge aided filtration but was not economical. Experiments with precipitants showed that sulphuric acid could be used to the best advantage in separating the excess water and increasing the rate of filtration.

Centrifuging activated sludge in an imperforate bowl produced a good cake having a moisture content of 88 per cent. A cake of 80 per cent moisture content was obtained from sludge acidified with sulphuric acid. This cake could be economically dried to 10 per cent moisture content in hot-air driers.

[**Ash of *Atriplex halimus* as a fertilizer**], J. COULOUMA (*Bul. Agr. Algérie, Tunisie, Maroc.*, 2. ser, 27 (1921), No. 4, pp. 66, 67).—Analyses of samples of ashes of *A. halimus* are briefly reported showing a potassium oxid content of 42.09 per cent. The chlorids are high and the alkaline carbonates very low.

Analyses of commercial fertilizers, R. N. BRACKETT and H. M. STACKHOUSE (*South Carolina Sta. Bul.* 212 (1922), pp. 43).—This bulletin contains the results of actual analyses and guaranties of 722 samples of fertilizers and fertilizer materials collected for inspection in South Carolina for the season 1921–22.

AGRICULTURAL BOTANY.

The development and winter injury of cherry blossom buds, R. H. ROBERTS (*Wisconsin Sta. Research Bul. 52 (1922), pp. 24, pls. 4, figs. 7*).—In an earlier publication (E. S. R., 41, p. 53) the author showed that unequal winter-killing of different parts of a tree bears a direct relation to the degree or stage of development of the buds at the beginning of winter. Additional investigations (E. S. R., 42, p. 342) have shown the relation between the stage of development of the blossoms and the extent of the injury due to low temperatures. In the present report an account is given of investigations that are thought to explain why the stage of development is closely related to winter injury of the blossom buds. It is claimed that plant tissue may have three stages of susceptibility to cold injury: Relative hardness of embryonic tissue, previous to the appearance of large central vacuoles in the cytoplasm of the cells; tenderness of tissue with large vacuoles in the cytoplasm; and hardness of older or secondary tissues as seasonal maturity is attained.

It is considered that there is but one period of differentiation of cherry blossoms in Wisconsin, and this is in the early part of July. The rate of development after initial differentiation of the floral parts and not the actual time of such differentiation is said to govern the total amount of development of the buds before the winter season. The extent of winterkilling of the blossom buds of the cherry is claimed to be in direct relation to the amount or degree of their development at the beginning of winter. The condition which renders the more advanced buds susceptible to injury is believed to be the presence of large central vacuoles in the cytoplasm of the cells. Embryonic tissue, having dense cytoplasm, is relatively more resistant to cold in some plants than are tissues composed of cells with large vacuoles.

Some climatic and topographic characters in the rings of the yellow pines and sequoias of the Southwest, A. E. DOUGLASS (*Abd. in Science, 55 (1922), No. 1433, p. 653*).—The author reports the average growth of the giant sequoia in the General Grant National Park as 7.6 cm. (3 in.) per century for the last 500 years. The growth varies from half of this to double the amount in locations with respectively unfavorable and favorable water supply. The relation of tree growth to solar activity has been pointed out elsewhere (E. S. R., 47, p. 226).

The probable action of lipoids in growth, D. T. MACDOUGAL (*Abd. in Science, 55 (1922), No. 1433, pp. 653, 654*).—After reviewing the work of other investigators on the fundamental composition of protoplasm, especially with reference to the importance of lipoids, the author concludes from his experiments that all substances which form watery emulsions or set as reversible gels are to be included in the hydration or growth mechanism. The results are given of experiments which are said to show that lecithin was found to exert but little effect on absorption when incorporated in the plasma, but to influence absorption in a marked manner when used as a peripheral layer or plasmatic membrane. The reaction is said to be of such a character as to suggest the liquefaction of a lipoidal layer, but the experiments are not considered as offering decisive evidence of the occurrence of such a layer, although nothing was observed that could be interpreted adversely to such an arrangement of material in the cell.

The rôle of manganese in plants, J. S. MCHARGUE (*Abd. in Science, 56 (1922), No. 1438, p. 85*).—The author concludes that manganese is necessary in the plant economy. Plants were grown in nutrient compounds free from manganese, and compared with plants which received manganese. All the plants were grown until those that received manganese showed signs of fruiting, and

a few were grown to maturity. Where manganese was withheld normal growth continued for about six weeks, after which the plants became chlorotic, the young leaves and buds died, and the plants made no further growth. Plants to which manganese was available grew in a normal way and fruited where they were grown to full maturity.

Oligodynamic phenomena. O. DRECHSEL (*Centbl. Bakt. [etc.]*, 2. Abt., 53 (1921), No. 13-14, pp. 288-311).—This contribution on the physiology of poisoning, dealing mainly with studies on *Spirogyra*, is said to show that the injurious action of highly attenuated solutions of colorants, alkaloids, and salts of heavy metals is conditioned by a general storing up of the injurious bodies.

Oligodynamy is the term here applied to such a poisoning, due to the massing in living cells of materials which when abundant are injurious.

The killing of *Spirogyra* occurred when the amount by weight of copper sulphate present reached the ratio of 1 : 50,000 as compared with the weight of the organism.

Distilled water is injurious under all conditions to *Spirogyra* when comparatively few threads are present. This is owing to the solubility of the nutritive salts and is due particularly to the removal of calcium. Such removal apparently adds to the injurious effectiveness of the heavy metals.

[**Sex ratios**], C. CORRENS (*Hereditas*, 2 (1921), No. 1, pp. 1-24, figs. 6).—A study of sex ratios and the factors influencing their displacement deals partly with animals as well as with plants.

The relation between body size and organ size in plants, E. W. SINNOTT (*Amer. Nat.*, 55 (1921), No. 640, pp. 385-403, figs. 2).—Correlation between body size and organ size in plants, though less obvious than in animals, does exist and may be of practical importance. The present paper records an attempt at careful analysis and interpretation of size relations in a series of bean plants, 562 in number, grown during 1918 as part of another investigation. Coefficients of correlation were determined between plant size (dry weight of shoot), dry weight of fruit, number of leaves, number of pods, and number of seeds; and the average dry weight per plant of leaf, pod, and seed.

A positive and significant though usually small correlation was found in each case. An increase in the size of the plant is accompanied by an increase in the size of its organs if we consider comparatively small plants only, but after a certain size is reached any further increase in plant size is not followed by increase in organ size. Separate correlations between plant size and organ size made for small plants and for larger ones showed a very decided correlation in the former and practically none at all in the latter. These facts suggested that the size of an organ may not be correlated with body size at all but rather with the size of the axial growing point from which it develops. Favorable material to test this hypothesis directly was afforded by twigs and leaves of *Acer saccharum*. The correlation between the blade volume of a given leaf pair and the cross-sectional area of the pith of the internode below (used as an index to the size of the growing point from which the leaves had developed) was found to be high ($+0.807 \pm 0.024$).

It is, therefore, concluded that the size of a plant organ (leaf, fruit, or seed) is dependent not upon the body size of the plant on which it is borne but rather upon the size of the growing point from which it developed.

[**Genetic studies on *Tropaeolum*, *Clarkia*, and *Impatiens***], H. RASMUSON (*Hereditas*, 1 (1920), No. 3, pp. 270-276).—Some of the principal data are here given that have been obtained from genetic studies conducted since 1912 on *T. majus*, *C. elegans*, *C. pulchella*, and *I. balsamina*, the studies on the different plants applying to such characters as leaf and flower color, growth, and height.

Mendelizing chlorophyll factors in *Allium cepa*, J. RASMUSSEN (*Hereditas*, 1 (1920), No. 1, pp. 128-134).—A descriptive and tabular account of studies on colors in *A. cepa* deals with the four variations found (white, yellow, chlorin yellow, and t-chlorin yellow, the last being intermediate between yellow and chlorin yellow which was so named and described by Baur in 1910), with the splittings observed, and with the factors supposed to be involved.

Genetic analysis of two species of *Godetia* and of their hybrids, H. RASMUSSEN (*Hereditas*, 2 (1921), No. 2, pp. 143-289, figs. 29).—These investigations were undertaken in order to procure a complete genetical analysis of *G. whitneyi* and *G. amoena*, also to determine whether the hybrids between these two species show segregation in F_2 , and, if this is the case, whether this segregation follows the same principles as the segregation of varietal crosses. The results and conclusions are given in detail.

A haploid mutant in the Jimson weed, *Datura stramonium*, A. F. BLAKESLEE, J. BELLING, M. E. FARNHAM, and A. D. BERGNER (*Science*, 55 (1922), No. 1433, pp. 646, 647).—The authors describe a haploid mutant of *Datura* which is said to be a genetic novelty among flowering plants, in that it is a sporophyte and yet has the somatic chromosome number characteristic of the gametophyte of the species, also the chromosomes while in sets of one each, undergoing a process of reduction though without synaptic mates.

Variation and heredity in *Lupinus*, L. L. BURLINGAME (*Amer. Nat.*, 55 (1921), No. 640, pp. 427-448, figs. 2).—The genus *Lupinus* presents an assemblage of closely related and difficultly separable species. The present paper reports some results of a study during six years in field and garden of *L. vallicola apricus*, *L. pipermithii*, and *L. nanus*, the variations described concerning the form and color of the flower, the shape and size of the pod, and the color and markings of the seeds. These results are presented in detail.

[*Oenothera* crosses], N. HERBERT-NILSSON (*Hereditas*, 1 (1920), No. 3, pp. 312-342, figs. 3).—Assumptions are offered under which, it is claimed, the constitution of *O. lamarckiana* with regard to the lacta-velutina characters may be analyzed factorially in the same way as for other plants. Critical notes are offered also regarding views on related forms.

Pollen tube growth rate and disturbances in the Mendelian numbers in *Oenothera lamarckiana*, N. HERBERT-NILSSON (*Hereditas*, 1 (1920), No. 1, pp. 14-67, fig. 1).—Disturbances observed in the Mendelian segregation in *O. lamarckiana* are attributed to the long style. The longer the style the greater the differences in the gamete representation in spite of the fact that the relative difference in the rate of growth of the pollen tubes is the same. There are thought to be no real grounds for the opinion ascribed to De Vries, Gates, Shull, and Bartlett that segregation in *O. lamarckiana* is a unique phenomenon.

The inheritance of flower color in *Pisum*, H. TEDIN (*Hereditas*, 1 (1920), No. 1, pp. 68-97, pl. 1, figs. 2).—Investigations dealing exclusively with flower colors and not yet completed are described as showing the mode of inheritance of flower colors in *Pisum* to be very simple.

Crosses between homozygous light purple and common whites give without exception purple-flowered F_1 , and F_2 segregates in purple, violet, rose, light purple, and white in the ratio 27:9:9:3:16. Apparently purple color is conditioned by three factors.

It is noted that the hilum of the violet-flowered individuals has an abnormal structure, and that these plants show also a very poor development of the seeds. The abnormal structure of the hilum appears to be directly connected in some way not explained with the factor combination indicated, regarding which investigations are contemplated.

A constant humidity case, C. F. HOTTES (*Abs. in Phytopathology*, 11 (1921), No. 1, p. 51).—A description is given of a plant chamber in which it is possible to maintain a constant humidity within a constant variation of about 1 per cent.

FIELD CROPS.

Handbook of breeding of agricultural plants, C. FRUWIRTH (*Handbuch der Landwirtschaftlichen Pflanzenzuchtung*, Berlin: Paul Parey, 1922, vol. 1, 6. ed., rev., pp. XVIII+443, pls. 8, figs. [91]; vol. 3, 4. ed., rev., pp. XVI+227, figs. 45).—Revised editions of the volumes noted (E. S. R., 45, p. 35) covering I, General Principles for the Breeding of Agricultural Plants, and III, Breeding of Potatoes, Jerusalem Artichokes, Flax, Hemp, Tobacco, Hops, Buckwheat, and Legumes.

Handbook of cereal culture, F. SCHINDLER (*Handbuch des Getreidebaus*, Berlin: Paul Parey, 1920, 2 ed., rev. and enl., pp. XII+500, figs. 130).—A revision and enlargement of the work noted earlier (E. S. R., 20, p. 1033).

The best varieties of grain, C. E. SAUNDERS (*Canada Dept. Agr. Pamphlet 11, n. ser.* (1922), pp. 12).—Brief descriptions are given of the varieties of winter and spring wheat and rye, oats, barley, emmer and spelt, field peas and beans, seed and fiber flax, and buckwheat, recommended for the several Provinces of Canada from the results of trials at the Dominion experimental farms and stations.

Winter grain in Saskatchewan, M. CHAMPLIN (*Saskatchewan Univ., Field Husb. Circ. 3½* (1921), pp. 11, figs. 7).—Cultural directions are suggested for growing winter wheat and winter rye in Saskatchewan. Winter wheat presents so many difficult problems under Saskatchewan conditions that a large acreage is hardly expected, and emphasis is laid on the value of winter rye.

Silage experiments, T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Bul.* 227 (1922), pp. 16, fig. 1).—Cultural methods with corn and soy beans for silage are suggested from the results of comparisons of various crops and of grain and silage corn varieties at several stages of maturity. Cultivation (E. S. R., 37, p. 535) and fertilizer treatments (E. S. R., 42, p. 21) applicable to growing corn for silage have been noted. Analyses of corn, sorghum, soy beans, cowpeas, and millet are included.

Corn and soy beans are considered the best of the crops tested for silage at the station. Corn gave a greater total acre yield and more total nutrients per acre than any other silage crop tested. Prolific varieties, such as Cockes and Virginia Ensilage, produced larger acre yields and generally more total nutrients than grain varieties, although the latter yielded a higher quality of silage. The proper varieties of soy beans are considered those best adapted to hay production in the several sections of the State.

The most green material and total nutrients per acre were secured when corn was cut with the kernels in the glazed stage. More bushels of corn per ton of silage were produced in early plantings than in later plantings. With the grain varieties, about 50 bu. of corn were obtained for each 10 tons of silage produced, both in glazed and mature stages, while the silage varieties in the glazed stage made about 30 bu. for each 10 tons of silage.

[**Report of field crops work in Oklahoma**] (*Oklahoma Sta. Rpt. 1921*, pp. 9-15).—Experimental work with field crops is reported, continuing that noted heretofore (E. S. R., 45, p. 480).

Among the leaders in the variety tests were Strawberry, Bloody Butcher, and Chisholm corn; Fulghum, Improved, and Extra Early oats; Oklahoma Triumph 44 cotton; Kanred, Miracle, and Michigan Amber wheat; Abruzzi

rye; Kingfisher barley; New Era, Groit, Whippoorwill, and Brabham cowpeas; Mammoth Yellow, Sable, Ebony, Arlington, and Jet soy beans; Spanish peanuts; Sumac and Orange sweet sorghum; and darso and Blackhull White kafir among grain sorghums. Breeding work was continued with cotton, wheat, barley, grain sorghum, and a dwarf strain of Sudan grass.

Wheat manured made 15.7 bu. per acre and that unmanured 7.3 bu., in comparison with 26-year averages of 22.6 and 13.5 bu., respectively. After 5 years of continuous culture kafir and oats yields were less than when grown in rotations on the same soil during the period, whereas cotton was scarcely affected by continuous culture.

Kafir made its highest yields when cultivated shallow. A plat where the weeds were hoed without disturbing the soil equaled plats cultivated deep. Kafir in alternate rows with cowpeas apparently does not outyield that in the ordinary width of row. Kafir spaced from 9 to 12 in. in the row again gave the highest grain yields, while the most forage was returned from heavier rates of planting.

Sudan grass seeded at from 3 to 12 lbs. per acre in 3.5-ft. rows made from 2.23 to 3.14 tons, while close drilled seedings of from 12 to 40 lbs. gave from 4.82 to 5.13 tons, with maximum production from a 19-lb. rate. The hay from drilled plats was finer and with less dirt.

Peanuts receiving ordinary cultivation outyielded those with soil thrown to the plants during spike formation, reversing previous results.

[**Work with field crops in Guadeloupe, 1920-21**], J. S. DASH (*Guadeloupe Sta. Agron. Rep.*, 3 (1920-21), pp. 9 1/4, 21-44).—The further progress of earlier experiments (E. S. R., 45, p. 734) is reported for the year ended with June, 1921. B. H. 10 (12), B. 6450, Ba. 6032, and B. 147 averaged the highest in sucrose production of the sugar cane varieties on black soils during the seasons 1918-1920 and 1919-21, and B. S. F. 13 (8), B. H. 10 (12), B. 67, and Ba. 11569 led on red soils in the average of these years.

[**Report of field crops work in North Wales, 1920-1921**], R. A. and E. J. ROBERTS and M. GRIFFITH (*Univ. Col. No. Wales, Bangor, Dept. Agr., Rpts. Expts.*, 1920-1921, pp. 3-21, 29-39, 51-54).—These pages describe the continuation of earlier work (E. S. R., 44, p. 227).

The 4 per cent solution of copper sulphate usually employed was found more effective in destroying charlock than a strong solution of sulphate of ammonia and was less expensive. Spraying with a solution of sulphate of ammonia checked the grain quite as much as copper sulphate and destroyed beans, which the latter hardly affected. The solutions of sulphate of ammonia used checked the growth of thistles, which recovered in a few weeks but did not mature before harvest. The manurial value of the sulphate of ammonia solutions is minimized, and even may be detrimental to the crop by prolonging the growth period where the soils have sufficient nitrogen already.

[**Report on variety tests, 1920**, U. STAFFELD and K. BABOWITZ (*Arch. Deut. Landw. Gesell.*, No. 312 (1921), pp. XV+161).—The tabulated results are presented from numerous variety tests with oats, barley, spring and winter wheat, rye, field beets, sugar beets, field peas, and field beans carried on throughout Germany in 1920.

[**Report of field crops work in India, 1920-21**] (*India [Dept. Agr.] Rev. Operations, 1920-21*, pp. 2-30, 34, pl. 1).—The progress of experiments with field crops carried on by the Imperial and Provincial Departments of Agriculture in various centers in India in the year 1920-21 is reviewed as heretofore (E. S. R., 46, p. 131).

[**Alfalfa in the Delta**, G. B. WALKER (*Mississippi Sta. Bul.* 209 (1922), pp. 14, figs. 5).—Cultural directions are outlined for alfalfa in the Delta region of

Mississippi, and experiments with the crop at the Delta Substation are summarized. Experiments with alfalfa as hog pasture have been noted (E. S. R., 36, p. 471).

The use of 1,000 lbs. of basic slag, alone, was considered the most practical and profitable, although the addition of 4 tons of limestone to the slag gave the maximum increase in fertilizer trials. Untreated checks averaged over 4.75 tons of hay per acre. Disco No. 28 and South Dakota No. 12, pedigreed strains of common, have outyielded such hardy varieties as Grimm and Cossack.

Alfalfa is said to thrive profitably on buckshot land badly infested with coco or nut grass, and when once secured, a thick stand will usually hold for two or three years. Such meadows should not be grazed with hogs, particularly if the ground is wet, as they will destroy the alfalfa while rooting for the nuts.

The value of the increased yield from cotton grown after three years of alfalfa on warm buckshot land was \$76 per acre more than from cotton continuously. The increases were also very noticeable during the second and third years after alfalfa.

Dwarf forms in barley, B. MIYAZAWA (*Jour. Genetics*, 11 (1921), No. 3, pp. 205-208, pl. 1).—A dwarf plant appeared among the offspring of a back-cross by Goldenmelon barley on an F_1 of Goldenmelon \times Sekitori at the Kanagawa Experiment Station, Japan. It was characterized by small stature, two rows, long awns, and late ripening, and although tillering very abundantly the shoots were smaller than either parent in agronomic qualities and more than half failed to produce spikes. The normal type was recessive to this form, and all dwarfs seemed to be heterozygous. Further tests showed a segregation of sterile-dwarf : dwarf : normal = about 1 : 2 : 1. The sterile dwarf form produced as many as 152 shoots per plant, and was distinguished by slow growth, small stature, and low resistance to cold and disease.

Moki Lima beans, R. H. FORBES (*Sultan. Agr. Soc., Tech. Sect., Bul.* 9 (1921), pp. 22, pls. 4, fig. 1).—Moki Lima beans, originally grown by the Hopi Indians of Arizona, are apparently a distinct group of the Sleva type (*Phaseolus lunatus*) of Lima beans and are characterized by semidwarf habit, with non-twining vines of moderate length permitting cultivation as a field crop. The group includes varieties with white, pale buff, red, and variegated seeds, and the beans are well adapted to hot, dry climates. Moki Limas may come in rotation after winter vegetables, beans, wheat, and barley, and in place of corn before clover, wheat, or cotton. Yields of 910 kg. per feddan (2,078 lbs. per acre) have been obtained with irrigation. Cultures of *Bacillus radicumicola* from the U. S. Department of Agriculture were established and abundant tubercles produced in experimental cultures.

Analyses by J. A. Prescott showed the nitrogen and starch content of Moki Limas grown in Egypt, not tuberculous, to amount to 2.84 and 38 per cent, while the average of those from Arizona, presumably tuberculous, amounted to 3.37 and 35.8 per cent, respectively.

Tentative buckwheat grades, F. J. VASEK (*Grain Dealers Jour.*, 49 (1922), No. 2, p. 137).—Tentative rules adopted by the Cleveland Grain and Hay Exchange for the grading of buckwheat are given in brief.

A preliminary report on a study of various clovers as found on three soil experiment fields of Kentucky with special reference to root systems, E. N. FERGUS and W. D. VALLEAU (*Abstr. in Science*, 56 (1922), No. 1438, p. 86).—The progress is reported of an ecological and pathological study of clovers on three soil types of Kentucky, made to determine the causes of clover failure.

Stands of red and alsike clover were practically equal throughout the first year whether on productive or "clover sick" soils. Much diminution of stand

seems to occur on most soils during the second summer, reaching 100 per cent on the least productive soil. Root rot was present to some extent on all root systems examined. Those developed in the least productive soils were badly diseased or dead at the end of the first season, and all taproot systems examined were diseased or dead at the end of the second season. The persistence of a clover plant after death of the taproot depends on its ability to produce new roots from the crown.

Characteristic proteins in high and low protein corn, M. F. SHOWALTER and R. H. CARR (*Abs. in Science*, 56 (1922), No. 1436, pp. 24, 25).—The protein content of corn is subject to wide variations by breeding and selection. The highest protein ear produced by the authors contained 18.43 and the lowest 7.62 per cent. A study of the relative abundance of the different proteins in corn showed zein to be the important protein which varied most, averaging 50.28 per cent in high protein and 31.85 in low protein corn. The other protein averages were glutelin 38.11, globulin 3.7, albumin 3.92, and amide 2.81 per cent in the high protein and 52.15, 1.53, 8.21, and 6.25 per cent, respectively, in the low protein corn. Zein averaged 57.24 per cent in high protein popcorn.

The decline in the yield of Egyptian cotton and its causes, G. C. DUDGEON (*Bul. Imp. Inst. [London]*, 19 (1921), No. 2, pp. 160–174).—The chief accepted reasons for the decline in cotton production per acre in Egypt include degeneration of the productive powers of the soil due to an excessive proportion of cotton in the rotation employed, rise in the water table in the Delta without adequate contemporary drainage, an insufficient supply of manure and fertilizers to meet the increased call upon the soil, with the introduction of noxious substitutes; ravages of insect pests with the extensive culture of an earlier maturing but less productive variety; and agrarian disturbance.

Cawnpore-American cotton.—II, Further field trials, 1918–1920, spinning trials, and market organization, B. C. BURT (*Agr. Research Inst. Pusa, Bul. 126* (1921), pp. 13).—A pure race, which yields well, has a staple of from $1\frac{1}{8}$ to $1\frac{1}{2}$ in, and is suitable for spinning 25s warps and 30s wefts in Cawnpore and up to 36s in Lancashire, has been isolated from the mixed acclimated exotic known as Cawnpore-American (E. S. R., 41, p. 828) cotton. Over 1,100 acres of this selection were grown by cultivators in 1920, and an independent market for unginned American cotton has been established in Cawnpore.

The effect of manuring with superphosphate and sannai on the yield of crops on indigo planters' estates in Bihar, especially of rabi crops in the season 1918–19, W. A. DAVIS (*Agr. Research Inst. Pusa, Indigo Pub. No. 6* (1920), pp. 30).—Considerable increases in the indigo crop were obtained by the use of superphosphate, either alone or with sunn hemp.

Varieties of oats in cultivation, C. V. B. MARQUAND (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C. No. 2* (1922), pp. 44, pls. 7).—The present classification, which deals particularly with varieties of oats cultivated in the British Isles, arranges the groups of varieties under their respective wild species. The detailed descriptions, with synonyms, include 6 species, 7 subspecies, and 112 varieties and subvarieties. The fatuoid mutations of cultivated varieties are also treated.

In considering constant and inconstant characters, the author found that the extent of soil moisture is far more potent in affecting the number of spikelets on the panicle than the amount of artificial manure in the soil. The percentage of awned spikelets in the panicle of plants from unselected varieties is constant, though probably dependent upon multiple factors. The presence or absence of marginal hairs on the lamina is similarly genetic. These char-

acters are considered safe to employ for classification and diagnosis of the varieties under all conditions. Contrarily, grain weight, height of plant, number of spikelets in the panicle, and number of tillers are so affected by environment as to be considered in themselves quite unreliable for identifying plants.

Peanuts, E. B. FERRIS (*Mississippi Sta. Bul.* 208 (1922), pp. 3-14).—A revision of Bulletin 130 (E. S. R., 23, p. 40).

Morphology and physiology of potato varieties, J. SYPNIEWSKI (*Pam. Inst. Nauk. Gosp. Pulawach.*, 1 (1920), A, pp. 41-57; abs. in *Ztschr. Pflanzenzücht.*, 8 (1922), No. 3, p. 260).—Compared with late varieties of potatoes earlier varieties possessed shorter stalks, more stalks per plant, fewer leaves per stalk, shorter internodes, greater total leaf area, smaller green weight in the whole section of the plant above ground, smaller green weight of stalks and petioles, and larger green weight of leaf tissue. The earlier varieties also were found to have less dry substance in the above-ground portion and in its component stalks, petioles, and leaf tissue, a higher rate of transpiration, larger stomata, larger palisade and epidermal cells, and lower osmotic pressure.

The Ministry's trials of varieties of potatoes, 1921 (*Jour. Min. Agr.* [London], 29 (1922), No. 2, pp. 163-170).—Epicure with 6.2 tons per acre led the first earlies, Great Scott and King George with 10.5 tons each the second earlies, and Kerr Pink with 11.45 tons the late varieties of potatoes in trials throughout England and Wales (E. S. R., 45, p. 828). Sprouted seed produced 5.8 tons per acre as compared with an average of 4 tons from unsprouted seed.

The origin of rice and the history of its culture in Egypt, V. M. MOSSÉRI (*Bul. Union Agr. Égypte*, 20 (1922), No. 143, pp. 5-15).—Although wild rice has been found in Asia, tropical Africa, and Australia, an Asiatic origin has been assigned to the prototype of the numerous varieties now cultivated. Nevertheless, the author holds that botanical probabilities authorize tropical Africa as the primary source, with the cereal passing to Asia at a remote date, where it could self-disseminate at several points before any cultivation. While rice culture in China dates back from 48 to 50 centuries, it is generally admitted that rice came from the zone extending from South India to Cochin China. It may have spread from that zone about 3,000 B. C. to the east toward China, more recently to the west and the south across India into Persia and Arabia, and later to Egypt and Europe.

Philological indications are that the Persians did not borrow rice culture from India, and it can be presumed that rice culture might have been practiced by both races living side by side before the Indo-Aryans occupied the Punjab and the Perso-Aryans settled Iran. The fact that the ancient Persian name, from which the Arabian, Greek, and European words are derived does not appear to originate from Sanskrit but is related thereto could substantiate the basis of an African origin. Ancient Egypt did not know rice, the cereal being introduced relatively recently, in the reign of the Caliphs, with the direct source unknown.

Philippine rice, A. H. WELLS, F. AGCVOILA, and R. T. FELICIANO (*Philippine Jour. Sci.*, 20 (1922), No. 3, pp. 353-361).—A compilation of the analyses of kernels of different varieties of rice is presented. Compared with rice grown in the United State, Philippine rice is poorer in protein and carbohydrates other than crude fiber, but is richer in fats and phosphorus and contains more moisture, crude fiber, and inorganic salts. It is suggested that improvement in the quality of Philippine rice should be directed toward increase in protein and carbohydrates.

Improvement of sisal by breeding, K. BRAUN (*Ztschr. Pflanzenzücht.*, 8 (1922), No. 3, pp. 278-290).—Observations are recorded on the lengths of fibers,

weights of fibers and leaves, and the life duration of sisal selections at Amani, in the former colony of German East Africa.

Sugar-beet growing in Holland and Belgium, R. G. RIDLING (*Jour. Min. Agr. [London]*, 29 (1922), No. 1, pp. 65-71, figs. 3).—Practices followed in sugar-beet production in Holland and Belgium are described briefly.

Variation in the composition of sugar beets left undug over winter, V. ŠKOLA (*Ztschr. Zuckerindus. Českoslovak. Repub.*, 46 (1922), No. 22, pp. 239-243).—Analyses of sugar beets remaining undug during the winter showed that the leafage lived on and formed albumins from simple nitrogenous material, a process comparable with after-ripening. The greater portion of the leaf nitrogen was lost, only a small part being taken up by the root. The ash of the leaves diminished to a much greater extent than that of the roots. The sugar decreased, being consumed as reserve material by the plant, which prepared itself naturally for the second growth year.

Selecting mother sugar beets, E. E. DOWN and O. B. WINTER (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 36-38).—A practical outline of the specific-gravity method of improving sugar beet seed stock.

Germination and preservation of sugar cane pollen, T. S. VENKATRAMAN (*Agr. Jour. India*, 17 (1922), No. 2, pp. 127-132, pl. 1).—A more detailed discussion of the test noted (E. S. R., 45, p. 830), with a method for the preservation of sugar cane pollen.

The selected arrows are cut very early in the morning, long before anther protrusion, with about 1 ft. of stalk retained. The end is cut afresh under water, the cane portion being then stuck into a ball of wet clay, and the arrow proper wrapped in tissue and brown paper and laid in a bamboo crate. Correct humidity is maintained by frequently sprinkling water over the crate, care being taken not to wet the arrow. When pollen is required, an arrow is removed, unwrapped, part of the cane cut off, and the arrow placed in a bottle of water in a fairly warm room without air currents. The anthers are said to then liberate pollen in about one-half hour.

The sugar industry in Natal and Zululand, E. WUTHRICH (*Internatl. Sugar Jour.*, 24 (1922), No. 281, pp. 243-247).—A concise account of the sugar industry in Natal and Zululand.

Sweet clover in Saskatchewan, M. CHAMPLIN and L. E. KIRK (*Saskatchewan Univ., Field Husb. Circ.* 35 (1922), pp. 18, figs. 5).—Practical instructions for the production of sweet clover hay, seed, and pasture in Saskatchewan are given, with the results of experiments with the crop.

White sweet clover has yielded slightly more than the yellow and has proved somewhat hardier. Nurse crops generally reduced the yield of sweet clover seeded on fallow ground. The fact that stands were secured with nurse crops on fallow in two dry years is believed to indicate that sweet clover can be used as a rotation crop to follow small grains. The returns from seedings in rows at different distances apart were conclusively in favor of close seeding, both as to the yield and the quality of the hay. No material difference in yield of seed was found between close and wide spacing. Seeding trials favor about 2 lbs. of seed per acre in cultivated rows for the production of both hay and seed.

Storing and bedding sweet potato stock, F. W. GEISE (*Virginia Truck Sta. Bul.* 39-40 (1922), pp. 223-234, figs. 8).—Practical information is presented concerning the storage requirements and selection of good seed stock and the preparation and control of hotbeds. The moisture and temperature control in a large storage house during the season of 1921-22 is described in some detail.

Fertilizing the wheat crop in Ohio, C. E. THORNE (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 7-8, pp. 112-121).—The experiments (E. S. R., 46, p. 334) reported

gave indications that on every soil in the State wheat in rotation with clover will give a profitable return from a moderate dressing of acid phosphate, that muriate of potash will generally more than cover its cost on the average soil, and that on a few soils nitrate of soda may be used with profit, provided the phosphorus requirement is first supplied. However, if either potash or nitrogen be substituted for phosphorus before this demand is met a decline may occur in the possible increase, and if either potash or nitrogen be used at the cost in ready-mixed fertilizers losses will often be sustained with potash and generally with nitrogen.

[Reports of the Official Seed Testing Station for England and Wales, 1920 and 1921] (*Jour. Min. Agr. [London], Sup. 20 (1921), pp. 19, figs. 2; Natl. Inst. Agr. Botany, Off. Seed Testing Sta. England and Wales, Ann. Rpt., 4 (1921), pp. 14, fig. 1*).—The average variety and germination are tabulated for 22,903 samples of seed received in the year ended July 31, 1920, and 23,577 in the year ended July 31, 1921.

During the fiscal year 1919-20 red, alsike, and white clover seed, imported in large quantities from Czechoslovakia, showed impurities amounting to 5.1, 8.3, and 6.3 per cent, respectively. Dodder was found in 75 per cent of the red clover samples, 44 per cent of the alsike samples, and 11 per cent of the white clover samples. Only about one sample in five of Chilean clovers was dodder free.

Germination of indigenous grass and clover seeds, R. G. STAPLEDON (*Jour. Min. Agr. [London], 29 (1922), No. 2, pp. 118-125*).—The germinating capacity and other characteristics of seed from plants in their natural habitats are compared with seeds grown and harvested at Aberystwyth, Wales, and with commercial samples.

The seed of indigenous species of grass and clover collected from various habitats tends to be of relatively poor germinating capacity, due particularly to the ravages of insects and to the difficulty of harvesting large quantities of seed under suitable and similar conditions. Once-grown seed appears to be attacked less by insects and to germinate more satisfactorily. The use of once-grown indigenous seed in mixtures for long duration and for permanent grass is suggested as a possibly desirable practice.

Depth of sowing grass and clover seeds, R. D. WILLIAMS (*Jour. Min. Agr. [London], 29 (1922), Nos. 1, pp. 53-60; 2, pp. 132-137*).—The optimum depth for red clover in tests at Aberystwyth, Wales, appeared to be $\frac{1}{2}$ - $\frac{3}{4}$ in., white clover $\frac{1}{2}$ - $\frac{1}{2}$ in., perennial rye grass $\frac{1}{2}$ -1 in., cocksfoot $\frac{3}{4}$ - $\frac{1}{2}$ in., meadow fxtail $\frac{1}{2}$ - $\frac{3}{4}$ in., and rough-stalked meadow grass $\frac{1}{2}$ - $\frac{1}{2}$ in. The results indicated that red clover should never be left uncovered, and satisfactory stands from surface seedings of the other seeds were generally secured only in wet weather.

Hardy alfalfa and clover seed, G. R. MEGEE (*Michigan Sta. Quart. Bul., 5 (1922), No. 1, p. 16, fig. 1*).—Careful examination during the spring after the winter of 1921-22 showed that Italian red clover winterkilled 50 per cent, and it was severely injured by anthracnose during the early summer. Italian red clover matured about 10 days earlier than strains grown for some time in northeastern United States, and the second growth was much slower to develop. Arizona-grown common alfalfa and hairy Peruvian also winterkilled badly and yielded much less than Hardigan, Grimm, and common from Idaho, Montana, and the Dakotas.

Two new western weeds, S. F. BLAKE (*Science, 55 (1922), No. 1426, pp. 455, 456*).—*Bassia hyssopifolia* and *Centaurea picris*, natives of the Caspian Sea region, are described and indicated, in this contribution from the Bureau of Plant Industry, U. S. D. A., as threatening to become weeds of some importance in the arid and alkaline districts of the West.

Russian knapweed: A new weed in Kansas. R. L. HENSEL and E. P. HAMLING (*Kansas Sta. Cir.* 94 (1922), pp. 4, figs. 2).—Attention is called to the appearance in northeastern Kansas of Russian knapweed (*Centaurea piriis*), and its eradication is urged. It is believed that the seed of the plant was brought into this country in shipments of Turkestan alfalfa.

HORTICULTURE.

Catalogue of the library of the Massachusetts Horticultural Society. M. C. HEWETT ET AL. (*Cambridge: Univ. Press*, 1918, pt. 1, pp. VII+372; 1920, pt. 2, pp. X+373-587).—This catalogue, enumerating approximately 22,000 volumes, including pamphlets, is prepared in two parts, the first of which comprises a list of authors and titles arranged alphabetically by authors, and the second includes a classified arrangement of the same material according to subjects. In addition, the library is said to contain a collection of approximately 11,000 nursery and seed catalogues printed in many languages and of unusual historical value, some dating back to 1776.

Bibliography on the preservation of fruits and vegetables in transit and storage, with annotations, compiled by K. G. RICE (*U. S. Dept. Agr., Library, Bibliog. Contrib. No. 4* (1922), pp. [2]+76).—This mimeographed bibliography comprises titles of publications of an investigational and historical nature, as well as more popular material, issued prior to July 1, 1920.

Horticulture [at the Illinois Station] (*Illinois Sta. Rpt.* 1921, pp. 18, 19).—Miscellaneous activities are briefly reviewed without the presentation of data.

Studies with the peach at Olney gave further evidence (*E. S. R.*, 46, p. 444) of the detrimental effect of cowpea cover crops to the peach under conditions obtaining during the experiments. Records of the amount of bloom (the fruit being destroyed by frost) showed 300 per cent more blossoms on unfertilized trees in clean culture than on unfertilized trees in cowpeas. The application of potassium to the cowpea plats corrected this detrimental influence.

In studies in the greenhouse it was found that the continuous use of the same soil led to a slight decrease in production unless proper treatment was given. Steam sterilization of greenhouse soil stimulated growth in the second and third crop, but left the soil so exhausted that the fourth crop was very small. Although acid phosphate combined with lime proved detrimental to lettuce, the mixture whether used alone or in combination with other fertilizers was of benefit to the tomato. The yield of Lima beans was greatly increased by inoculation. In tests conducted on a brown silt loam in central Illinois, the yield of tomatoes was increased by the use of commercial forms of phosphorus in connection with a cover crop. In tests on a yellow silt loam in Union County, the yield of tomatoes and melons grown in a three-year rotation was greatly increased by the substitution of cover crops for manure.

[Report of the Oklahoma Station] horticultural department (*Oklahoma Sta. Rpt.* 1921, pp. 23, 24).—A progress report for the year ended June 30, 1921 (*E. S. R.*, 45, p. 438), in which are presented brief statements of activities under various projects. Progress was halted in the study of factors affecting the setting of fruit on the tomato by the loss of all but four varieties from wilt disease. Of the four surviving kinds, the Marvel, Columbla, Norton, and Arlington, the Marvel yielded the best returns, but two plants suffered from wilt later in the season. The Appomattox pecan was the first of the paper-shell varieties to produce fruit in the station grove. Of five gooseberry varieties planted five years ago, only two, Houghton and Champion, survived. The Kansas black cap raspberry was the only variety to produce fruit. Early

Harvest and Dallas were the heaviest yielding blackberries. Data are presented relative to the yield per vine of several grape varieties.

Vegetables and truck for home use, Delta Branch Station, W. E. AYRES (*Mississippi Sta. Bul.* 210 (1922), pp. 16, figs. 10).—The results of varietal tests with various vegetable and berry crops are presented, largely in tabular form, in connection with general cultural information.

On a basis of yield and quality of fruit, Red Sunrise, Bonny Best, Early Detroit, and Stone are deemed the most desirable tomato varieties. In comparing five methods of training tomato plants, the largest yield was recorded on plants allowed to grow at will on a hog wire fence supported horizontally 1 ft. above the surface of the ground. Pruning the tomato vine is considered both unnecessary and undesirable. Among the largest yielding varieties reported are Early Snowball turnip, Irish Cobbler potato, Triumph sweet potato, Kelway Perfect Model beet, Bountiful green podded bean, Bantam Evergreen corn, Arlington White Spine cucumber, Tom Watson watermelon, and the Rocky Ford muskmelon.

Growth in seedlings of *Phaseolus vulgaris* in relation to relative humidity and temperature, C. F. PATTERSON (*Roy. Canad. Inst. Trans.*, 14 (1922), No. 31, pp. 23-68).—A report of an investigation, conducted at the University of Illinois, in which Red Valentine bean seedlings, propagated from seed of uniform size, were transplanted into jars of pure sand moistened to a desired degree with well water and placed in chambers subject to accurate temperature and humidity control. Part of the plants were grown in continuous darkness and part in darkness alternating with light. One root temperature, 25° C. (77° F.); two shoot temperatures, 20 and 30°; three relative humidities, 30, 60, and 90 per cent; and three soil moistures, 5, 20, and 60 per cent, were utilized in the tests; however, constant conditions were maintained with each individual series. Readings of shoot elongation were taken every 12 hours, together with measurements of the increase in the hypocotyl and in each internode. Temperature and humidity readings were obtained at three-hour intervals beginning at 7 a. m. and finishing at 10 p. m.

Elongation in the etiolated shoots of the beans grown in sand saturated with water either to 20 or 60 per cent proceeded as rapidly in a relative humidity of 30 per cent as in either 60 or 90 per cent. However, when grown in sand 5 per cent saturated, the shoots grew less rapidly in 30 per cent relative humidity than in either 60 or 90, with no difference between the latter two degrees. The rate of elongation in shoots grown in alternate light and darkness were influenced by relative humidity in a similar manner to those shoots grown in continual darkness. In the presence of both high and low relative humidity, etiolated bean seedlings elongated more rapidly in sand 20 per cent saturated than in sand 5 per cent saturated. The rate of elongation at 60 per cent saturation approached that of 20 per cent. The percentage of dry matter in the plants varied inversely as the soil moisture and the relative humidity. No significant change in the relation between the dry weights of roots and dry weights of shoots was induced by increasing the soil water from 5 to 60 per cent saturation.

In conclusion, the author believes that relative humidity as a factor in plant growth has been greatly overestimated. The moisture content of the substratum is deemed an important environmental factor, able to assist when sufficiently high in overcoming the harmful effects of low relative humidity and of high evaporation coefficients. A bibliography consisting of 125 titles is appended.

Factors influencing the profitable production of tomatoes for the early market and canning factory, with some cost of production studies, H. A. JONES (*Maryland Sta. Bul.* 248 (1922), pp. 153-187, figs. 9).—This is for the greater part a compilation of information relative to improved cultural practices in commercial tomato production, with results reported from the Maryland and other experiment stations cited to show the value of intelligent practices.

A study conducted at the Maryland Station in 1920 is briefly reported, in which was determined the effect upon yield and gross income of different methods of growing and handling Bonny Best plants. Potted plants proved much more profitable than those raised in greenhouse benches, in flats, or in outdoor seed beds. The greenhouse bench plants produced slightly the greater yield but were productive at a time when prices were at a low level.

The results of a cost of production survey started in 1919, in which data were procured on tomato growing on 11 farms, are briefly noted and show extreme variability in cost of production between the several farms. The cost varied from \$14.96 per ton where the yield was 11.18 tons per acre to \$130 per ton where the yield was only 0.85 ton per acre. The average cost of production was \$78.42, and the average yield was only 2.62 tons. The results are believed to show that profitable production depends largely upon improved cultural and marketing practices. This supposition is further supported by the records kept by a commercial grower over the 3-year period 1918-1920, showing consistently profitable tomato yields as a result of intelligent cultural practices.

Tables dealing with tomato diseases and insect pests are included.

The breeding of canning tomatoes, M. C. MERRILL and T. H. ABELL (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 133-138).—Comparable results to those of Myers (E. S. R., 31, p. 236) were obtained in strain tests with the tomato conducted at the Utah Experiment Station. Differences of 9 lbs. of marketable fruit per plant for Stone and 12 lbs. for Earliana were recorded between the highest and the lowest producing strains of these varieties. Notable differences were observed in the date of commencement of heavy production in various varieties.

Textbook of pomology, J. H. GOURLEY (*New York: Macmillan Co.*, 1922, pp. XV+380, pls. 8, figs. 40).—In preparing this book, which deals for the greater part with the physiological aspects of pomology, the author has drawn extensively upon the experimental results of his own and others' investigations. The systematic side of pomology is purposely excluded, and many of the simpler orchard operations are not discussed, on the assumption that the reader is already familiar with the elements of fruit growing.

Effects of cover crops in the orchard, H. THORNBEE (*Better Fruit*, 17 (1922), No. 1, pp. 11, 12).—In continuing his reports (E. S. R., 45, p. 741) upon the maintenance of fertility experiments under way at the Montana Horticultural Substation, the author presents in this paper a tabulated summary of the treatments of the various plats since the initiation of the experiments in 1908. The yields of the various plats in 1921 were similar to those of previous years and again indicated that, under the conditions obtaining, clover is a better cover crop than the pea, and that permanent clean culture has a disastrous effect upon the trees. Tabulated data showing the average trunk diameter and height of trees and computed yields per tree per acre are appended in tabular form.

The influence of sacking fruits upon the keeping quality, A. PETIT (*Rev. Hort. [Paris]*, 94 (1922), No. 4, p. 76).—Observations upon the keeping quality of Calville Blanc apples, part of which had been inclosed in paper sacks during the ripening period and part exposed to the open air, indicated no apparent difference in the keeping quality of the two lots.

Antiseptic treatment of stored pears, P. HUTINEL (*Rev. Vitic.*, 56 (1922), No. 1442, pp. 127-129).—A practical experience is described, wherein the author, after testing sulphur fumes and formalin as preventives, succeeded in suppressing a disastrous outbreak of storage rot in winter pears by immersing the fruits for 20 hours in a weak solution of Chinisol, a proprietary material obtained by treating oxyquinolin with sulphuric acid. The wounds on the treated pears dried quickly, and the fruit kept through its normal season. The flavor and other eating qualities are said not to have been affected in any way, and no injury resulted to anyone from eating the fruit. In 1921 the tests were successfully repeated upon artificially injured pears.

Suggestions on cherry production, C. C. VINCENT (*Wash. State Hort. Assoc. Proc.*, 17 (1921), pp. 139-143).—In addition to general information pertaining to soils, pruning practices, orchard heating, etc., data are presented relative to self-fruitfulness and cross-pollination tests with various varieties of sweet and sour cherries. The set of fruit obtained from flower clusters of Bing, Lambert, Napoleon (Royal Ann), Black Tartarian, May Duke, and Montmorency inclosed in paper sacks prior to the opening of the blooms were, in the order given, 0, 1.9, 0.36, 8.4, 7.1, and 18.2 per cent. thus indicating that Bing, Lambert, and Napoleon are practically self-sterile. At the same time, normally exposed blossoms of the three varieties mentioned gave respective sets of 26.6, 38.8, and 40.2 per cent.

In cross-pollination tests involving six varieties, Black Tartarian, the only sweet cherry to show merit as a pollinator, gave favorable results in all crosses in which it was used. Satisfactory results were also obtained with May Duke and Montmorency, varieties belonging to the sour group of cherries. As a practical recommendation, it is advised that in planning commercial orchards at least 1 out of every 10 trees belong to an effective pollinating variety.

The capulin cherry, W. POPENOE and A. PACHANO (*Jour. Heredity*, 13 (1922), No. 2, pp. 50-62, figs. 7).—A brief account describing a superior form of wild cherry occurring in the highlands of tropical America and believed by the authors to be *Prunus scrotina*. The fruit is said to be used in a similar manner to our cherries, eaten in the raw state, preserved, jellied, etc. On account of the usual manner of propagation, seedage, improvement has been, of necessity, very slow.

The raspberry situation in Michigan, R. E. LOREE and C. W. BENNETT (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 31-33, figs. 2).—As the result of an inspection trip through the raspberry districts in Berrien and Van Buren Counties, in which there was found a prevalence of serious disease, including anthracnose, cane blight, crown gall, leaf curl, mosaic, and blue stem, the authors suggest that greater attention be paid to the use of cover crops and fertilizers, that old canes be promptly removed after harvest, and that the young canes be thinned and headed back to promote a sturdy growth. A rigid inspection should be maintained in plant nurseries and in mature plantations to prevent the increase and spread of diseases.

Grape cuttings are resistant to drying, A. PETIT (*Rev. Hort. [Paris]*, 94 (1922), No. 3, p. 61).—The moisture content of cuttings of the Foster White Seedling grape held for 8 days in a room heated by a stove during the day receded from 53.1 to 50.2 per cent without causing any apparent injury to bud development. Cuttings of Madeleine Blanche exposed in the same environment for 31 days lost more moisture, 11.6 per cent, but suffered no permanent injury. The renewal of growth, however, was delayed 8 days, as compared with normally stored cuttings. The immersion for 24 hours in water of a part of a lot of cuttings which had been stored in a warm room for 23 days caused the treated

cuttings to renew growth 4 days earlier than the remainder of the lot. It is suggested that a part of the injury occurring to cuttings in transportation may be avoided by soaking them in water.

Studies in the viability of grape seeds, ZIEGLER and MORIO (*Landw. Jahrb. Bayern*, 11 (1921), No. 11-12, pp. 558-563).—Incidental to general grape breeding studies at Veitschöchheim, an investigation was made upon the germination of grape seeds. In tests in soil with seeds obtained in reciprocal crosses of Müller Thurgau and Puritan, it was found that the seed resulting from the use of Müller Thurgau as ovule parent had much greater viability than that of the reciprocal cross. Grape seeds placed in an unbeated room germinated more slowly than those located in a warm chamber but finally attained the same percentage. Seeds placed in filter paper, sand, composted soil, and turf gave respective germinations of 46, 36, 43, and 41 per cent.

Sylvaner seeds soaked for three days in spring water and then placed in filter paper, sand, compost, turf, and sawdust gave respective counts of 43, 44, 33, 43, and 43 per cent. The germination in sawdust was extremely rapid. In experiments with seeds immersed for 15 minutes in water heated to 40, 45, 50, 55, 60, 66, and 72° C. a very marked reduction in viability was observed above 55° (131° F.), and at 72° only 2 per cent of the seed grew. Seeds immersed for 1 hour in water heated to 25° and then treated for 30 minutes with various chemicals showed moderately increased germination in two instances, namely, with hydrochloric acid 5 per cent solution and potassium chlorid 10 per cent solution. Serious injury occurred in four instances, carbolic acid 5 per cent, mercury bichlorid 5 per cent, and with two proprietary materials.

A survey of the cranberry industry of New Jersey, C. S. BECKWITH and H. B. WEISS (*N. J. Dept. Agr. Circ. 45* (1922), pp. 13, figs. 9).—A statistical report regarding acreage, distribution, varieties, yields, etc., based on information procured for the most part by personal contact with the growers.

The citrus experiment station at Lake Alfred, W. NEWELL (*Citrus Indus.*, 3 (1922), No. 6, pp. 3, 18).—A brief account relative to the establishment of a new citrus substation at Lake Alfred, Fla., with discussion of the various experimental projects under way. Progress is recorded in the bud selection study conducted cooperatively with the U. S. Department of Agriculture. Five hundred rough lemon stocks have been planted, upon which will be budded selected types of the orange varieties Parson Brown, Homosassa, Pineapple, Valencia, and Lue Gim Gong.

Some varieties of citrus fruits for the Philippines, F. G. GALANG (*Philippine Agr. Rev.*, 15 (1922), No. 1, pp. 44-48, pls. 3).—Various species of citrus are discussed in relation to their behavior under Philippine conditions, their resistance to disease, and desirable varieties. Among the many species tested as stocks, *Citrus webberii*, a native of the islands, is especially esteemed on account of its resistance to disease and compatability with various cultivated species.

Legal restrictions on citrus fruits consigned to the United States, F. A. LÓPEZ DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 54* (1921), *Spanish ed.*, pp. 5-27, figs. 7).—This is a circular of information pertaining to the legal standards of maturity required in grapefruit and oranges designed for shipment from Porto Rico to the United States. Approved methods of testing fruits to determine the stage of maturity are described in detail, with various apparatus illustrated and tables given for computing the results.

The origin of the coconut, E. CHIOVENDA (*Webbia*, 5 (1921), No. 1, pp. 201-294).—This is an extended discussion in Italian concerning the original home of the coconut.

The dwarf coconut in Malaya, H. W. JACK and W. N. SANDS (*Malayan Agr. Jour.*, 10 (1922), No. 1, pp. 4-12, pls. 4).—A discussion of the probable origin of three dwarf coconut forms existing in Malaya.

From a study of the color, flower, and fruit characters of these dwarf palms, the author believes that certain characters are constant enough to allow a fairly accurate separation of dwarf forms from intermediate and tall forms in the nursery and thus to prevent the mixed stands which now occur to the detriment of the industry. Careful observations and study on the pollination of the coconut indicated that in Malaya the male and female phases are wholly or partly coincident, thus allowing for self-pollination, the manner of fertilization which is believed to prevail throughout the lowlands of Malaya.

[**Coconut fertilization experiments**] (*Trop. Agr. [Ceylon]*, 58 (1922), No. 6, pp. 327-335).—A study of the 1921 yields of plats of coconut palms at Chilaw receiving various fertilizer and cultural treatments again showed the largest yield of copra per palm on the plat receiving 8 lbs. of steamed bone meal per tree (E. S. R., 45, p. 347). This plat is described as the best in the series and the least seriously affected by drought. Applications of lime, both on heavy and on light soil, have given markedly increased crops associated, unfortunately, with small-sized nuts. The size of the nuts is improved by applications of nitrogen, preferably in the organic form.

The cultivation of pineapples, F. A. STOCKDALE (*Ceylon Dept. Agr. Bul.* 50 (1921), pp. 12, pls. 4).—This comprises general cultural information.

The culture of pyrethrum (*Pyrethrum cinerariaefolium*) in France, H. FAES (*Ann. Agr. Suisse*, 22 (1921), No. 6, pp. 434-438, figs. 3).—A brief account of the methods employed in growing, harvesting, curing, and manufacturing pyrethrum, a material which is used extensively in the preparation of insecticides for combating *Cochylis* and *Eudemis*.

Filbert culture and varieties, C. A. REED (*Better Fruit*, 17 (1922), Nos. 1, pp. 9, 18, 19; 2, pp. 20, 21, 22, 23).—A general discussion dealing with the status of the industry, necessity of standardizing varieties, methods of propagation, characters desired in varieties, and, finally, descriptive notes on a great number of varieties.

Winter injury to young walnut trees, 1921-22, L. D. BATCHELOR (*Calif. Dept. Agr. Mo. Bul.* 11 (1922), No. 5-6, pp. 445-449, figs. 3).—Following a general discussion of the nature of frost injury to young Persian walnut trees, the author describes in detail an occurrence of injury in the San Jacinto and Hemet Valleys, Calif., caused by low temperatures in the fall of 1921. A method of renewing the injured trees by training a new sprout for replacement is outlined. Furthermore, it is advised that irrigation of young walnut groves should be discontinued sufficiently early in the season to allow the young wood to mature previous to early frosts.

The Dahlia in Australia, E. E. PESSCOTT (*Melbourne and London: Whitecombe & Tomba, Ltd.*, pp. 122, pls. 12, figs. 2).—A general treatise discussing the evolution of the different types of dabbias and presenting cultural information.

Planting roadside trees, A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 40-42).—A brief discussion of tree species adapted for roadside planting, with suggestions relative to the proper distances, size of trees, etc. The text of an act of 1921 providing for the protection of trees and shrubs within the limits of public highways is given.

Tree repairing, B. R. MORTON (*Canada Dept. Int., Forestry Branch Bul.* 73 (1922), pp. 22, figs. 27).—Designed for the assistance of the tree owner, this pamphlet contains practical suggestions relative to the prevention of decay in trees by the proper removal of branches, treatment of pruning wounds, cleans-

ing and concrete filling of old wounds, and methods of supporting limbs in danger of breaking down.

FORESTRY.

Report on experimental forest planting at high altitudes of Maui and Hawaii, C. J. KRAEBEL. (*Hawaii. Forester and Agr.*, 19 (1922), No. 7, pp. 151-158, pls. 4).—This paper discusses the behavior of various Temperate Zone forest trees introduced during 1909 to 1911 into the Hawaiian Territory with the object of finding species adapted to the upper slopes of the mountains. The experimental plantations were established at approximate elevations of 6,500, 7,000, 8,000, and 9,000 ft. on Maui and at 7,000, 8,000, 9,000, and 11,000 ft. elevations on Hawaii.

Of a total of 86 species tested, 15 conifers and 4 deciduous trees proved more or less adaptable to island conditions. The influence of elevation was distinctly evident in that much better stands were obtained at the lowest levels. All four successful deciduous species were natives of Australia. Of the conifers, Coulter pine (*Pinus coulteri*) made the best growth and produced cones on plats located at 7,000 and 8,000 ft. elevation. However, on account of the low value of the wood, this species is placed second to white pine (*P. strobus*) in a list of 12 selected species.

The degree of success attained in the experiment is believed by the author to be sufficient to demonstrate the feasibility of afforesting the intermediate slopes of the Hawaiian mountains.

Relation of precipitation to height growth of forest tree saplings, C. F. KORSTIAN (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 260-267, fig. 1).—Measurements taken in 1919 of the annual growth of 143 western yellow pines and 111 Douglas firs growing in the vicinity of the U. S. D. A. Weather Bureau station at Grimes Pass, Idaho, showed in general a fairly close correlation between the rate of growth, as indicated by the length of internodes between whorls of branches, and the rainfall occurring in April and May of the same year. A striking exception to this correlation, found in the case of the 1914 growth of Douglas fir, was explained by the occurrence of both unusually high and freezing temperatures in April and May, causing severe injury in the vegetation.

Observations on the length of leaves of Engelmann spruce growing on a northern exposure in Big Cottonwood Canyon, Idaho, showed that in the dry season of 1919 the leaves averaged only 0.36 in. in length as compared with 0.71 in. for the years 1918 and 1920. The terminal twig growth was also noticeably shorter in 1919.

A bog forest, G. B. RIGA (*Ecology*, 3 (1922), No. 3, pp. 207-213, figs. 2).—This is a descriptive article relating to a small forest area consisting of a pure stand of lodgepole pine (*Pinus contorta*), located near Victoria, B. C., and believed to represent a very recent stage in which the forest has become the dominant type of vegetation, totally suppressing the sphagnum. The author bases his deductions upon the dominance of the pine, the abundant survival of Labrador tea (*Ledum groenlandicum*), the occasional survival of peat bog birch (*Betula glandulosa*), the presence of a layer of dead sphagnum, and the similarity between the deeper layers of the substratum and those of corresponding sphagnum bogs in Washington and Oregon.

Making the forests of Utah a permanent resource, C. F. KORSTIAN (*Utah Acad. Sci. Trans.*, 2 (1918-1921), pp. 177-181).—Following a statement of the existing forest resources of Utah and of the alarming rate of present use, the author urges the necessity of conserving the forests through intelligent silvi-

cultural practices, and briefly outlines the work of the U. S. D. A. Forest Service in Utah.

Impressions of European forestry, R. S. HOSMER (*Chicago: Lumber World Rev.*, 1922, pp. 80, figs. 63).—A series, published in pamphlet form, of eight letters prepared by the author while on an extended tour of Great Britain and Europe, during which he visited many of the most important forest schools and experimental stations and inspected many of the long-established and scientifically managed forests.

The titles of the component letters are as follows: Great Britain's Afforestation Program: Why It Was Undertaken; How It Is Being Carried Forward (pp. 9-17); Forests and Forestry in Sweden: Methods of Dealing with Privately Owned Forests—Supervision by Community Committees (pp. 18-25); Forestry in Norway and Denmark: Methods of Dealing with Privately Owned Forests—Government Supervision (pp. 26-34); A Few Observations on Forestry in Germany: A Visit to German State Forests—A Meeting with Dr. C. A. Schenck (pp. 35-43); Some Features of Forestry in France: Impressions Received During a Series of Hasty Visits to Certain Typical Forests (pp. 44-52); Two Distinctive Phases of French Forestry: Practical Accomplishments in Reboisement and Reclamation (pp. 53-62); City, Town, and Communal Forests: A Phase of European Forestry that Has Particular Significance for the United States (pp. 63-69); and Some European Forest Schools: An Account of Visits Paid to Forest Schools in Great Britain, France, Switzerland, and the Scandinavian Countries (pp. 70-80).

Progress report of forest administration in Coorg for the year 1920-21, H. C. BENNETT (*Coorg Forest Admin. Rpt.*, 1920-21, pp. [32]).—This is the usual annual report (E. S. R., 45, p. 646) relating to alterations in area, revenues, expenditures, etc.

Report of proceedings of the Australian Forestry Conference, Brisbane, April, 1922 (*Aust. Forestry Conf. Proc.*, 1922, pp. VIII+1½).—In addition to general discussion and routine business, numerous papers are included, among which are Forest Legislation in Tasmania—The Birth of a Forest Policy, by A. Hean (pp. 16-21); History of the Development of the South Australian *Pinus insignis* Forests, by W. Gill (pp. 26-28); The Redistribution and Readjustment of Tree Life as It Affects Australian and Tasmanian Forestry, by L. G. Irby (pp. 58-61); Past, Present, and Future Forestry Operations on Fraser Island, by F. C. Epps (pp. 68-71); The Trend of Forestry in Queensland, by J. H. Coyne (pp. 71-73); Notes on a Tentative Working Plan for Brooloo State Forest, by J. M. Fraser (pp. 74-78); Some Notes on Problems of Silviculture in Southern Queensland, by W. R. Petrie (pp. 79-81); The Need for Forest Engineering in Australia, by C. R. Paterson (87-90); The Reconciliation of Silviculture and Timber Exploitation, by L. G. Irby (pp. 94-97); Forestry Education in Australia, by E. H. F. Swain (pp. 99-103); The Place of Entomology and Plant Pathology in Modern Forestry, by H. Tryon (pp. 117-124); and The Future of Australian Forestry, by H. R. Mackay (pp. 133-135).

DISEASES OF PLANTS.

[Plant disease investigations at the Illinois Station] (*Illinois Sta. Rpt.* 1921, pp. 12, 13, 18).—Brief notes are given of experiments carried on cooperatively between the station and the U. S. Department of Agriculture on some cereal diseases. Two varieties of corn have been found that are immune to root rot in the southern part of the State. Seed from rough diseased corn produced 11 bu. per acre less than seed from medium-smooth ears that were nearly free from disease. Late planting did not reduce the yield from nearly

disease-free seed, but it did reduce the yield from diseased seed by about 12.5 bu. per acre. Corn root rot diseases were found more injurious on land cultivated under the grain system of farming than when the stalks were removed and the manure returned to the field.

In studies of flag smut of wheat, some varieties have been found that are quite resistant to the disease, late spring sowing reduced the amount of smut, and evidence was obtained that seems to indicate that soil infection is possible, though the spores of the fungus probably lose their vitality during the winter. Several varieties of wheat have been found that are immune to the so-called take-all disease in Illinois, indicating that this disease can be controlled by planting resistant varieties.

Experiments have shown that the apple blister canker may be prevented from spreading by the annual cutting out of the diseased wood and by sterilizing and disinfecting the operating tools.

Report of the division of plant pathology and botany, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1921, pp. 51-55, 56-58*).—In continuation of previous investigations of the yellow stripe disease of sugar cane (E. S. R., 44, p. 846), the author found that the occurrence of plasma-filled cells is not necessarily indicative of the disease, similar conditions having been observed in overripe cane that showed no indications of disease. The addition of large amounts of nitrogen to the soil was not found to cause the yellow stripe, nor was the disease found on corn in Porto Rico. The gumming disease of sugar cane is said to have spread rapidly in Porto Rico, and certain varieties of cane have been found to be especially subject to it.

Notes are given on the occurrence of miscellaneous diseases of coffee, bananas, grapefruit, etc. A species of *Fusarium* is said to be responsible for a root rot of grapefruit trees, several large trees having been killed in two groves.

Bacterial plant diseases in the Philippine Islands, C. G. WELLES (*Science, 56 (1922), No. 1436, p. 18*).—Attention is called to the prevalence of fungus diseases of plants in the Philippine Islands and the scarcity of bacterial diseases except those which have been introduced. The following bacteria which are the cause of plant diseases are reported in the Philippines: *Bacterium solanacearum*, the cause of tobacco and other solanaceous diseases; *Pseudomonas citri*, the cause of citrus canker; *P. campestris*, which attacks cabbage; *P. phaseoli*, on beans; *P. malvacearum*, on cotton; and an undescribed organism occurring on parsley. With the possible exception of citrus canker and the undescribed disease of parsley, none of these diseases or their hosts are considered indigenous to the Philippines.

[Phytopathological contributions], L. SAVASTANO (*R. Staz. Sper. Agrumic. e Fruttic. Acireale, Bol. 35-42 (1919-1921), pp. [50], figs. 13*).—These numbers (excepting No. 37), relating to various plants, deal, respectively, with root rots of useful Italian plants, constitutional chlorosis, cultural practices in connection with root rots, traumatic decortication, scald, dry gummosis, and a drying-up disease or gummosis.

[Plant diseases, Nairobi], W. J. DOWSON (*Kenya Colony Dept. Agr. Ann. Rpt. 1919-20, pp. 79-83*).—In this portion of the 1919-20 report of the mycological laboratory at Nairobi, an account is given of the opening in May, and of some facilities and activities of the laboratory.

The coffee leaf disease due to *Hemileia vastatrix* has now become universal, and is nearly always to be found toward the end of the long rains everywhere, except in the higher portions of Limuru and Kericho, the severity and damage depending largely upon the altitude and the state of cultivation and pruning of the plantations. Spraying has proved very beneficial. Of other coffee leaf

diseases, that due to *Cercospora coffeicola* has been pronounced but not very severe, the ripening berries not being attacked this year. A recently appearing leaf blotch is described as due to *Gloeosporium coffeanum*.

Coffee berries were attacked by a fungus, apparently a *Septoria* (*S. calcosa*?), producing a mottled appearance on the ripening fruits.

The die-back (*Colletotrichum coffeanum*) noted in the Thika district during the previous year did not reappear after spraying operations were carried out, but this fungus, associated with a Phomopsis, was found on die-back specimens in the Fort Ternan district. A new die-back associated with *G. coffeanum* was brought under investigation. A sudden wilt and cambium rot following an electrical storm and associated with a *Diplodia* was apparently checked by cutting the trees below the cortical discoloration.

Flax wilt disease (*Fusarium lini*) appeared at Kericho, having been introduced with imported seed. It was present also at Sotik and probably at Lumbwa. The *Macrosporium* disease was also discovered, though as yet of no great importance.

Oranges and citrus fruits showing dark discoloration were thought to be affected with black blight (*Capnodium* sp.) but mites were suspected. Young specimens of *Brachylaena hutchinsi* attacked by *Sclerotinia* sp. were subjected to continued study. A case of damping off of young seedlings of the East African cedar (*Juniperus procera*) occurring at Londiani was found to be due to a *Pythium*. The camphor tree disease is still under investigation, and pruning and spraying operations have been undertaken in connection therewith. Minor investigations were applied to apple canker (*Sphaecopsis malorum*), gummy exudation from lime fruits and twigs, bean rust (*Uromyces appendiculatus*), a slime on plantation rubber from Uganda (*Penicillium* sp.), a grapevine disease (*Pestalotzia uvicola*), mulberry leaf spot (*Septogloeum mori*), dahlia leaf spot (*Urophlyctis* sp.), potato early blight, sisal hail damage, and white rust (*Cyatopus candidus*) on *Diplotaxis inopinata*.

Plant diseases in the Western Province, IV. V. A. PUTTERILL (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 4, pp. 332-337, figs. 7).—This is a continuation of the reports previously noted (E. S. R., 47, p. 242). The diseases of the loquat here dealt with include *Fusicladium* or scab and *Entomosporium* blight, as regards causation, symptoms, and control.

Notes on new or rare species of rusts. W. H. LONG (*Bot. Gaz.*, 72 (1921), No. 1, pp. 39-44).—This paper describes four new species of rusts, namely, *Gymnosporangium cupressi* on *Cupressus arizonica*, *Ravenelia subtortuosae* on *Acacia subtortuosa*, *R. goodingii* on *A. suffrutescens*, and *R. cassiae-coveisii* on *Cassia coveisii*, giving also new data as to hosts and distribution of two other species of *Ravenelia*.

Factors affecting the germination of the sclerotia of *Claviceps*. F. T. MCFARLAND (*Abstr. in Science*, 56 (1922), No. 1438, p. 85).—The author has made a study of the sclerotia occurring on rye from various countries, and in the course of his investigations it was found that sclerotia more than one year old failed to germinate. When sown out of doors on the surface of the soil without any cover they showed good germination with many well-formed stromata, but the stalks were usually short. It appears that sclerotia of *Claviceps* must go through a rest period, the shortest duration of which is about eight weeks. During this time when the sclerotia are at rest, it is found that they should be kept stratified in moist sand. The removal of the cuticle of the sclerotia or treating them with salt solutions, after which all traces of salt were removed, did not injure their germinating power.

Protection of seeds and young plants against diseases and pests by soil sterilization, E. FOËX (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), July, pp. 242-254).—A general systematic account of soil sterilization methods concludes with discussion of the effects of various treatments on fungi, bacteria, and nematodes.

The use of sterilized soils in phytopathological research, J. JOHNSON (*Abstr. in Phytopathology*, 11 (1921), No. 1, p. 51).—Attention is called to the desirability of the use of sterilized soil in connection with the study of plant diseases, and some of the effects of sterilization on plant growth are described.

Selection and production of plants resistant to disease.—I. Grains, E. PANTANELLI (*Riv. Biol.*, 3 (1921), Nos. 2, pp. 172-198; 3, pp. 319-336, figs. 3).—A wide range of related literature is used as the basis of this discussion, dealing with wheat rust resistance under the heads of oscillations of resistance in individuals, diverse resistance in the variety, correlations between characters and varietal resistance, changes in resistance of varieties with change of environment, heredity of resistance, selection of resistant races, and creation of resistant races by means of crossing.

Seed-borne diseases, C. C. BRITTLEBANK (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 7, p. 447).—Take-all (*Ophiobolus graminis*) and flag smut (*Urocystis tritici*) are thought to have reached the United States from Australia (perhaps by way of Europe), as they appeared the same year in the same field. *U. tritici* is known to retain viability in the spores for at least eight years.

Copper-dust treatment for stinking smut, G. H. COONS (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 8-11, fig. 1).—The results of two years' experimental work for the control of stinking smut of wheat are given.

In 1920 powdered copper sulphate was found to control smut, but the germination of the wheat was affected to some extent. In 1921, by the addition of lime no bad effect was observed on germination, but as there was no smut present the effect on its prevention could not be determined. In the fall of 1921 smutted wheat was treated with formaldehyde by different methods; copper carbonate at the rate of 2 oz. per bushel; and dehydrated copper sulphate and lime at the rate of 2 oz. each per bushel. The formaldehyde treatment gave good control of smut but reduced the stand to some extent. The dry method of formaldehyde was less efficient than the sprinkling or the soak and skim method. The copper sulphate and copper lime treatments both reduced the smut to a low percentage and had no bad effect on germination.

Based on the results obtained, the author recommends the use of dust treatments for the prevention of stinking smut in wheat.

Resistance to *Heterodera schachtli* in certain barley varieties, its mode of inheritance, and its significance for practice, H. NILSSON-EHLE (*Hereditas*, 1 (1920), No. 1, pp. 1-34, figs. 4).—In contrast to the case of other cereals, barley shows striking differences as regards resistance to attack by nematodes (*H. schachtli*), the varieties ranging in this respect from fairly susceptible to entirely immune. These differences are typically hereditary, distinguishing regularly the varieties from one another. On crossing immune with nonimmune varieties, immunity proves to be dominant in F_1 , typical segregation occurring in F_2 and F_3 . Other characters usually undergo little modification in heredity. This applies to crop yield.

In contrast to the more severely attacked oats and wheat, the sensitive barley varieties increase and spread the nematodes to a greater extent.

Cabbage yellows, C. T. GREGORY (*Purdue Agr. Ext. Bul.* 104 (1922), pp. 8, figs. 7).—A popular description is given of cabbage yellows due to *Fusarium*

conglutinans, and the planting of resistant varieties is suggested as a means of preventing severe loss.

The mosaic disease of the Solanaceae: Its relation to phloëm necrosis and its effect on potato culture, H. M. QUANJER ET AL. (*Meded. Landbouwhooges.* [Wageningen], 17 (1919), No. 1-3, pp. 1-74, pls. 8, fig. 1).—In this extended summation of studies during a term of years on a group of potato diseases more or less confused ordinarily on account of similarity or association, the authors outline the results of observations on leaf roll and leaf curl as delimited by Appel (E. S. R., 19, p. 852). They have concluded that leaf curl (curly dwarf) is a more intensified form of mosaic, while for the term "leaf roll" they prefer phloëm necrosis or leptonecrosis.

These diseases are in many respects similar, especially during the first year. Both are contagious, the chief sources in nature being diseased plants which may be 1 to 3 yds. distant. The infection passes as a rule not through the air but through the soil. Overwintering in the soil has not been fully established at Wageningen for phloëm necrosis. In case of mosaic apparently no soil infection occurs.

In grafting experiments it was found that mosaic travels from tobacco to tomato and reciprocally in about two weeks. Spread from tobacco to potato or in the opposite direction has not been observed, though as regards grafting tomato on potato transmission occurred in case of certain varieties named.

The transmission of the mosaic disease occurs in a manner suggesting parasitic agency. Only the upper new leaves and axillary shoots acquire the symptoms of mosaic and related diseases; in other words, the contagion once introduced into the plant is directed with the flow of organic material to the growing tissues. The fact that this flow passes through the phloëm strands is most conspicuous in the case of phloëm necrosis where the tracks themselves have been already attacked. The authors claim to have shown how the transport of starch from the leaves downward is inhibited by phloëm necrosis. Healthy plants have conveyed all their carbohydrates to the tubers, but the lower leaves of the secondary diseased plants remain full of starch. In this type of plant phloëm necrosis proceeds from the base upward as the external symptoms do, and the stoppage in the translocation of starch is most effectual in the basal leaves. In the primarily diseased plants a little phloëm necrosis is found in the upper part of the stalk and the upper leaves. Here starch transport is inhibited, whereas the lower leaves are empty. The stalk (because of the delay in the transport) has not been able to pass on all its starch to the tubers.

Whereas the transmission of either of these potato diseases to the progeny of diseased plants through the tubers takes place without exception, transmission by way of the embryo is rather rare. In the case of tomato mosaic it sometimes occurs, though it is not known to occur in the case of tobacco mosaic.

The hypothesis of the degeneration of potato varieties as a consequence of continued vegetative reproduction is explained by the fact that the two diseases which have been considered as degeneration are always propagated vegetatively by tubers but only exceptionally by sexual reproduction. This hypothesis has been further supported by the fact that plants attacked by phloëm necrosis or by mosaic are more susceptible to *Phytophthora infestans* than healthy potato plants of the same variety. Further possibility is discussed.

The influence of soil temperature on potato scab, L. R. JONES, H. H. MCKINNEY, and H. FELLOWS (*Wisconsin Sta. Research Bul.* 53 (1922), pp. 35, pls. 5, figs. 9).—In order to determine the influence of soil temperature on the development of potato scab due to *Actinomyces scabies*, experiments were

carried on in the greenhouse and in the field in which potatoes were grown in scab-infested soil held at various temperatures.

Five series of experiments were conducted in the greenhouses using the "Wisconsin tank" method. Seed tubers from a single source and a single strain of *A. scabies* were used in all the experiments. The soil temperature was held at seven gradations ranging from 11 to 30.5° C. (51.8 to 86.9° F.). The results show that the development of the scab is influenced by soil temperature. The disease developed at all the temperatures experimented upon but was comparatively slight at either extreme. The optimum soil temperature for scab development, as determined by the number of scabby tubers, was found to be about 23°, and the conclusion is reached that 22° may be accepted as about the optimum soil temperature for scab development under the conditions of the experiment. In field trials the highest development of scab took place at 25°.

The available evidence is said to indicate that the scab parasite as an independent organism is favored by relatively high temperatures, while the potato plant functions better at relatively low temperatures. The influence of temperature upon the prevalence of the parasite in the soil may be cumulative from season to season, whereas the influence upon the host plant is immediate and temporary. The immediate relation of temperature to the development of scab is considered to be more closely correlated with its influence upon the potato tuber development than with that upon the growth of the parasite.

Annual report of the expert in cane diseases (1920-21), F. S. EARLE (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1921*, pp. 59-62).—The principal activity reported upon is a study of varieties of sugar cane in reference not only to their resistance to disease but also their agricultural value.

Chemical changes in yellow-striped sugar cane (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt. 1921*, pp. 18, 19).—Investigations are said to indicate that qualitative tests of healthy and diseased sugar cane parts do not have value as diagnostic characters. Qualitative tests of the photosynthetic activity of healthy and yellow-striped sugar cane, conducted by E. D. Colón, showed a decidedly inhibitory effect of yellow stripe on the photosynthetic activity of the plants as shown by the iodine test for starch.

Striga as a root parasite of sugar cane, J. C. LUTHRA (*Agr. Jour. India*, 16 (1921), No. 5, pp. 519-523, pls. 3).—A serious sugar cane pest reported in September, 1920, as occurring on the "bet" lands which lie above the flood water and are very suitable for sugar cane cultivation, proved on examination to belong to the genus *Striga*, two species being present which were later identified as *S. densiflora* and *S. euphrasioides* and which have been observed to occur in different fields. These arise from the bases of the canes in large numbers and may form clusters some distance away but in connection with the canes through the roots. The parasite was first noticed about seven years before the date of the present account.

The canes attacked may make very poor growth, resembling drought stricken plants. They may be killed completely, or they may be very little affected by the attack.

The *Striga* attaches itself to the underground portions of the cane by means of haustoria. Many offshoots are developed by the parasite which produces seeds that are minute and very numerous, germinating and reproducing the plant if sugar cane is grown in the soil the next season. Studies made on the haustoria and their activities are outlined. The plant can elaborate its own food and is, therefore, ranked as a semiparasite. Cotton is not susceptible.

Blackfire and wildfire of tobacco and their control, F. D. FROMME and S. A. WINGARD (*Virginia Sta. Bul.* 228 (1922), pp. 19, pls. 2, figs. 10).—The authors describe two bacterial diseases of tobacco, blackfire which is caused by *Bacterium angulatum*, and wildfire by *B. tabacum*. The chief method of introducing both diseases into the field is said to be through the setting of diseased plants, and the severity of infection of the disease in the field is determined by the degree of infection of the seedlings and also by the weather conditions that obtain during the growing season. The severity may also be modified by the quantity and kind of fertilizer used. As these diseases have for the most part their origin in the seed bed, seed selection and disinfection and plant bed sanitation are recommended for their control.

The brown bark spot of fruit trees, D. B. SWINGLE and H. E. MORRIS (*Montana Sta. Bul.* 146 (1921), pp. 22, figs. 6).—A description is given of a disease of fruit trees that has been under observation for several years. Apples and pears appear to be affected to a considerable extent, while peaches, plums, prunes, and cherries are more resistant.

The disease is characterized by the death of the buds on certain branches, elevated brown spots on the bark, and death of the portions of the tree above ground, the bark being the principal seat of disease. As a result of numerous investigations it has been demonstrated that the disease is not contagious and is not caused by a parasitic organism. Largely from negative evidence the authors are inclined to the belief that brown bark spot is caused by some fault in the chemical composition of the soil. Based on this theory, it is recommended that more attention be given to building up orchard soils for the prevention of the disease.

European canker [of apples and pears in Oregon], S. M. ZFLLER (*Oreg. Grower*, 3 (1921), No. 2, pp. 3, 5-7, figs. 5).—Since 1918 the so-called European canker has been known in Oregon. The disease, which affects both apple and pear, is described as to symptoms exhibited locally.

For the most part there is good evidence that infections take place at small, sappy pruning cuts or in crotches. Wherever the bark of the host has become devitalized, as through sun scald or winter injury, the fungus obtains easy access and from there spreads to the healthier tissues. Sometimes the fungus starts in the edge of anthracnose cankers on D'Anjou pear. In an orchard of Bosc pears where nearly every tree has some infections of the European canker there is considerable bark injury due to the freeze of December, 1919. From many of these winter injury areas cankers are spreading with extreme vigor. Suggestions are offered regarding protective measures.

Stem end rot of apples, C. C. BARNUM (*Science*, 55 (1922), No. 1435, pp. 707, 708).—A description is given of a stem end rot of apples, due to *Penicillium expansum*, which was observed in the spring of 1921 on apples in California that had been in storage at 32° F. and later held for a few days at 45°.

In the fall of 1921, mature Yellow Bellflower apples were picked from trees with the fruit spurs attached, carefully disinfected, the fruit spurs then removed, and the ends of the stems inoculated with a culture of *P. expansum*. Of the six apples treated in this manner, four developed characteristic stem end rot and were soon completely decayed, while check apples kept in good condition for three months. Yellow Newtown apples were treated in the same manner, and at the end of six weeks all apples so inoculated were entirely decayed. Washings made from the attached leaves on some of the apples used in the experiments showed the presence of *P. expansum*, and this is thought to indicate the prevalence of the organism in the trees at the time of harvest. The results of these experiments are held to prove that stem end infection of apples

is a possibility. Though retarded in cold storage, the rot makes some progress at a temperature of 45°, and at room temperature the decay is very rapid.

The causes of specialization in Ascomycetes.—I, *Monilia cinerea* on cherries, K. KILLIAN (*Centbl. Bakt. [etc.]*, 2. Abt., 53 (1921), No. 22-24, pp. 560-597, pl. 1, figs. 2).—Studies carried on at the Proskau and the Bromberg stations are detailed for *M. cinerea* on cherries as regards specialization of the fungus.

Studies of *Monilia* spp. on other fruit trees are in progress, as are also studies testing some results of the work above noted.

Peach yellows and little peach, M. T. COOK (*Bot. Gaz.*, 72 (1921), No. 4, pp. 250-255, pls. 2).—Studies on peach yellows and little peach were based on a comparison of the structure of the corresponding parts (diseased or sound), the relative amounts of starch in these parts during morning and afternoon, and its relative location. No important differences of structure were noted. Data were obtained regarding starch, and the basis of this report is a comparative study of the results of photosynthesis and translocation of carbohydrates in healthy or in diseased trees.

Studies on both leaves and new growths indicate that the translocation of starch is partly or completely inhibited in diseased trees. The production of large premature fruits is also a characteristic symptom of yellows, and this feature is identical with or similar to that noted in a tree that has been girdled. In trees affected with little peach, however, the symptoms, so far as the fruit is concerned, are just the reverse, the fruit being somewhat smaller and ripening later than normally.

The evidence as discussed suggests that the translocation of starch is greatly reduced or completely checked in trees affected with either of these diseases, or that have been girdled and injured by label wires, borers, or at the collar as a result of freezing. In all cases an accumulation of starch in the leaves results, which may account for the leathery texture but does not offer an explanation of the willowy growth of the final stage of the yellows. If the translocation of carbohydrates is reduced or prevented, however, it may have a secondary effect on the tree, resulting in the willowy growth. This and other facts mentioned indicate that some of the symptoms of these diseases are due to reduced or inhibited translocation of carbohydrates.

Dry lime-sulphur solution v. lime sulphur in the control of peach leaf curl, G. P. WELDON (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 5-6, pp. 170-172, fig. 1).—Experimentation was carried out, making comparative tests against peach leaf curl (*Exoascus deformans*) of liquid lime sulphur at 1 gal. to 10, 20, and 30 gal. of water, and of dry lime sulphur 2 lbs. to 10, 20, and 30 gal. of water, the commercial fungicides being employed.

At the maximum strength both the wet and the dry fungicide gave practically perfect protection, except when missing probably occurred. At the medium strength a 20 per cent infection proved the equal insufficiency, commercially speaking, of both fungicides. At the lowest concentration both fungicides showed greater but still equal insufficiency. The checks showed for the Sims variety over 90 per cent of leaf curl infection.

The manufacturers' claim for dry lime sulphur that certain organic materials incorporated during its manufacture add to its fungicidal value appears to be borne out by this test, the value of this preparation depending apparently not alone upon its sulphur content but also upon something else which may compensate for the reduction in the sulphur strength, thus rendering this spray about as effective as the liquid.

Eastern blue stem of the black raspberry, R. B. WILCOX (*U. S. Dept. Agr., Dept. Circ. 227 (1922), pp. 12, pl. 1*).—An account is given of eastern blue stem of the black raspberry, a disease which has become quite prevalent in the region about Cleveland, Ohio.

The general effect produced upon the plant is a gradual stunting and reduction of vigor. When affected tips are planted they make little growth and by fall are easily recognized as being diseased. The following spring they start growth feebly or not at all. Microscopic examinations of tissues of the plants have not indicated that eastern blue stem is associated with bacteria or fungi, isolations having failed to yield any organism capable of reproducing the disease. Some features of the disease are said to strongly indicate that the trouble is a disease of the mosaic type.

Eastern blue stem is said to become established in the new fields through planting of diseased tips, and thus far no variety has been found sufficiently resistant to justify its exclusive adoption in infected districts. Applications of lime sulphur for the control of anthracnose where blue stem was prevalent had no apparent effect in reducing the disease. For control the use of stock from sound plants is recommended, and where the disease appears in plants in their first season's growth, roguing in August and September and the following June is recommended. For plants in their second season, roguing should be done before harvest, and in mature fields it can be done effectively following the removal of old canes after harvest.

Citrus canker control: A progress report of experiments, H. A. LEE (*Philippine Jour. Sci., 19 (1921), No. 2, pp. 129-173, pls. 2*).—Citrus canker field investigations in the United States having been rendered impossible by the regulations looking to its quick eradication, studies on that disease were begun in the Philippine Islands in the summer of 1917, the primary purpose being to determine whether citrus canker can be controlled by means other than the destruction of the trees; that is, by the use of fungicides and of cultural methods, with consideration of the possible utility of resulting ideas and methods in the southern United States.

The development of the experiments, as herein detailed, is said to have shown that in addition to preventive sprays the factors contributing largely to minimizing canker infection are removal of sources of infection by pruning and drastic clean-up sprays, stimulation of foliage growth to occur at periods of the year unfavorable to canker dissemination or development, the control of violent winds by windbreaks and orchard situation, and the control of chewing insects. The preventive sprays showing some degree of success were Bordeaux mixtures and Burgundy mixtures of various concentrations. Copper sprays were not wholly successful, although they effected tangible reductions in canker infections.

The most important consideration, as regards control, is a knowledge of the reaction to the disease of the different species and horticultural varieties, the wide range in the susceptibility of the species of citrus necessitating separate discussion of canker control possibilities for each host or class of hosts.

The conclusion is apparently safe that control upon the very susceptible lime and grapefruit varieties is not economically feasible by the methods employed, though control may be practicable as regards sweet oranges of Florida origin and such varieties of less susceptibility. Control was very easily obtained and was hardly necessary upon the mandarin orange varieties, the calamondins, and the citrons. Attention has been called to several exceptions from the extreme susceptibility of the lime and grapefruit varieties, and it is thought that such exceptions may be of value for cultivation in regions where citrus canker prevails.

An unsuccessful attempt to obtain complete eradication of citrus canker without total destruction of the trees was conducted on a small isolated plat of calamondin, mandarin orange, and lime trees.

In a district or region in which the extremely susceptible varieties such as the limes and grapefruits constitute the important commercial orchards, either complete eradication of the affected host plants or substitution of less susceptible hosts appears to be the only means of preventing severe losses from this disease. From the results presented in this paper such is not the case, however, with the less susceptible species.

A pap paw leaf spot caused by a *Phyllosticta* sp., P. A. VAN DER BIJL (*So. African Jour. Sci.*, 17 (1921), No. 3-4, pp. 288-290).—A leaf spot of papaya referred to as *P. caricæ-papayæ*, and recorded as being fairly common in Natal, is described as to characters and behavior. The economic importance of the disease is due to its reduction of the assimilating leaf area, though evidences indicate that the fungus may also cause a papaya fruit rot.

Pecan rosette, J. W. FIBOR (*Ga. Agr. Col. Bul.* 258 (1922), pp. 12, figs. 4).—The results are given of an experiment for the control of pecan rosette which the author considers is due to the inability of the root system of some pecan trees to become adapted to unfavorable soil conditions. In the experiment reported, a thick layer of pine needles was placed about the trees and the effect was noted in subsequent years. As a result of the mulching, the amount of rosette shown on the different trees was very greatly reduced.

Hevea brown bast, P. E. KEUCHENIUS (*Centbl. Bakt. [etc.]*, 2 Abt., 55 (1921), No. 1-4, pp. 14-74, figs. 33).—A report in systematic detail of studies on brown bast, which is said to be the most important and widespread disease of *H. brasiliensis* in the eastern Asiatic region, indicates a method of management involving principally regular inspections and removal of diseased portions.

The economic value of a study of the nematodes, with remarks on the life history of *Heterodera* in South Africa, J. SANDGROUND (*So. African Jour. Sci.*, 17 (1921), No. 3-4, pp. 322-334).—Besides a discussion of nematodes affecting domesticated animals and man, a brief account is given of nematodes said to be of agricultural importance, including *Aphelenchus armerodus*, parasitic on violet buds; *A. cocophilus*, causing diseases of coconut palms; *A. pyri*, rotting pears; *A. fragariae*, destructive to strawberry; *H. schachtii*, attacking cereals; *H. radiculicola*, attacking many economic plants; *Tylenchus acutocaudatus*, causing a banana disease; *T. biformis*, parasitic in sugar cane roots; *T. devastatrix* (*T. dipsaci*, *T. scandens*), attacking a wide range of plants; *T. oryzae* (*T. angusta*) on rice plants in Java; *T. mahogani*, on mahogany; *T. penetrans*, on roots of several plants; *T. semipenetrans*, on roots of citrus plants; *T. similis*, in roots of sugar cane and banana; *T. sacchari*, causing sugar cane sereh; and *T. tritici*, causing wheat earcockles.

A general account is given of the life history of *Heterodera* in South Africa, also a more special account, with reference to South Africa, of the activities of *H. radiculicola*, *H. schachtii*, *T. tritici*, and *T. devastatrix*.

Two new genera of nematodes, with a note on a neglected nematode structure, M. C. HALL (*U. S. Natl. Mus. Proc.*, 59 (1922), pp. 541-546, figs. 2).—The author erects the genus *Oslerus* for *Filaria osleri* of Cobbold, 1879, and *Hyostrongylus* for *Strongylus rubidus* of Hassall and Stiles, 1892.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Venomous animals and venoms, M. PHISALIX-PICOT (*Animaux Venimeux et Venins*. Paris: Masson & Co., 1922, vols. 1, pp. XXV+656, pls. 4, figs. 232; 2, pp. XII+864, pls. 13, figs. 289).—The first volume of this large work deals with

the subject under the headings of protozoans (pp. 1-14), coelenterates (pp. 15-76), echinoderms (pp. 77-99), worms and crustaceans (pp. 101-176), myriapods (pp. 177-206), arachnids (pp. 207-314), insects (pp. 315-464), mollusks (pp. 465-485), and Pisces (pp. 487-628). The second volume deals with batrachians (pp. 1-174), venomous lizards (pp. 175-219), serpents (pp. 221-318), Ornithorhynchus (pp. 319-328), and the functions and usages of venoms (pp. 329-342), respectively.

The author deals with the venomous functions of animals, the venomous apparatus, the venoms and their properties, the function and use of the venoms, and the envenomation and its treatment.

A 50-year sketch history of medical entomology and its relation to public health. L. O. HOWARD (In *A Half Century of Public Health*. New York: Amer. Pub. Health Assoc., 1921, pp. 412-438).—This is a concise account of the advance of knowledge of the rôle of insects and arachnids in the transmission of organisms pathogenic in man and the domestic animals. The importance of a close cooperation by the pathologist and the economic entomologist in investigational and control work with insect-borne diseases is emphasized.

Fumigation with hydrocyanic acid gas in greenhouses on a commercial basis. E. R. SASSER and C. A. WEIGEL (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 200-204).—The author presents details in tabular form of the results of fumigation of commercial greenhouses. The results show that the common greenhouse insects can be controlled by persistently using weak dosages, and that under the proper conditions such dosages will not reduce the market value of the plants. "Large houses may be satisfactorily separated by the use of canvas or muslin curtains, thus obviating a serious problem of the past in open range houses. It is evident from the results thus far obtained that some plants, for example carnations and orchids, may be fumigated while in bloom without injury to the flowers."

One year of the Crop Protection Institute. W. C. O'KANE (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 209-213).—This is a brief statement of the progress of the movement during the previous year.

Annual report of the division of entomology (1920-21). G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt.*, 1921, pp. 47-49).—In discussing the transmission of mosaic disease of sugar cane by insects (E. S. R., 44, p. 159; 45, p. 453) reference is made to the fact that E. W. Brandes, in experiments conducted at Washington, D. C., succeeded in transmitting the disease in most cases when the virus was injected either experimentally or by means of the corn leaf aphid (*Aphis maidis* Fitch) into young healthy shoots at the growing point. This aphid occurs on corn and sorghum in the United States and Porto Rico but has never been found on sugar cane in the field, and Smyth was unable to keep it alive on sugar cane in Porto Rico. It is pointed out that at the present time there is no one insect which, because of its abundance on sugar cane in all parts of Porto Rico, may properly be suspected of being the agent of transmission of mosaic disease in even the majority of the field infections.

In a survey made of the coffee and banana insects of Porto Rico, *Lachnosterina* spp. were found to be the most important of the banana pests, and the leaf miner, *Leucoptera coffeella* Stain., which is present in all parts of the island but does the most damage at higher elevations, is the most important coffee pest. The tobacco splitworm (*Phthorimæa operculella* Zel.) was the most important insect of the year, having caused serious injury to tobacco.

Twelfth annual report of the State entomologist of South Dakota for the period ending June 30, 1921. H. C. SEVERIN (*S. Dak. State Ent. Ann. Rpt.*, 12 (1921), pp. 29, figs. 2).—The author reports upon the more important

insect and plant diseases found in the nurseries of South Dakota and makes preliminary reports upon the Cicadidae, Membracidae, and Cicadellidae of the State.

[Economic insects in South Dakota and their control] (*S. Dak. State Ent. Circs.* 25 (1920), pp. 38, figs. 26; 26 (1922), pp. 7, fig. 1; 27 (1918), pp. 6, figs. 2; 28 (1922), pp. 14, figs. 2; 29 (1922), pp. 6, figs. 2; 30 (1918), pp. 10; 31 (1922), pp. 9).—These circulars relate, respectively, to Spraying Machinery and Accessories, by G. I. Gilbertson; Cockroaches and Their Control, The Pear, Cherry or Plum Slug, The Chinch Bug, and The Striped Cottonwood Leaf Beetle, all by H. C. Severin; Nursery Inspection Law of South Dakota; and Quarantine Orders Issued by State Entomologist of South Dakota, to be Effective On and After May 15, 1922, Until Otherwise Ordered.

[Insect pests in British Honduras], W. R. DUNLOP (In *Report on the Economic and Natural Features of British Honduras in Relation to Agriculture*. London: [West Indies Imp. Dept. Agr., 1922], pp. 18–21).—This report includes references to insect enemies of the coconut palm, bananas and plantains, sugar cane, and forest trees, field and vegetable crops, and live stock.

Insects and other animal pests injurious to field beans in New York, I. M. HAWLEY (*New York Cornell Sta. Mem.* 55 (1922), pp. 949–1037, pls. 3, figs. 16).—This is a report of studies, conducted at the laboratory at Perry, of the more important enemies of field beans in New York State, namely, the seed-corn maggot, *Hydomyia ciliatula* Rond. [not *Phorbia fusciceps* Zett.] (pp. 949–977); the imported field gray slug, *Agriolimax agrestis* L. (pp. 977–1000); the pale-striped flea-beetle, *Systema taeniata* Say (pp. 1000–1011); the green clover worm, *Plathypena scabra* Fab. (pp. 1011–1014); the bean weevil (pp. 1014, 1015); the blue-banded millepede, *Julus caeruleocinctus* Wood (pp. 1015–1017); the solanum root louse, *Triphidaphis radicumicola* Essig (pp. 1017, 1018); the wheat wireworm *Agriotes mancus* Say (p. 1018); the red spider, *Tetranychus telarius* L. (pp. 1018, 1019); white grubs or May beetles, *Phyllophaga* sp. (p. 1019); the rose chafer (pp. 1019, 1020); the southern corn rootworm, *Diabrotica duodecimpunctata* Fab. (p. 1020); the bean leaf beetle (pp. 1020, 1021); the apple leafhopper (p. 1021); and grasshoppers including *Melanoplus atlantis* Rll., the red-legged grasshopper, and *M. bivittatus* Say (p. 1021).

Brief mention is also made of injuries to beans in the pod caused by three hemipterous insects, namely, *Adelphocorus rapidus* Say, *Euschistus variolarius* P. & B., and the tarnished plant bug (pp. 1021–1023), and of the rôle of insects in the transmission of bean diseases (pp. 1023, 1024). A bibliography of 18 pages of the respective insects is appended.

The most important part of the investigation is that with the seed-corn maggot. The larva was found, under field conditions, in beans, peas, corn, seed potatoes, and alfalfa roots. The loss caused by it to bean growers in New York in 1917 was very high, reaching 40 per cent out of 10,478 acres in Erie County and from 50 to 75 per cent of 16,000 acres in Monroe County. The results of experiments on artificial control measures, such as coating the seed before planting and treating the soil with materials of a repellent nature, afford small hope for their future successful development. The pest thrives when oviposition takes place under wet conditions, and therefore it is wise to plant when the soil is dry and the earth is warm.

The imported field gray slug, which now occurs from Maine to California, is in wet years one of the two most destructive animal pests of field beans in New York. "During the rainy summers of 1916 and 1917, nearly all of the plants in some fields were attacked and many were entirely destroyed. Estimates of the losses on 21 farms in Orleans County in 1917 vary between 5 and

70 per cent. In 1918 the author saw a bean field in Monroe County in which about one-third of a 10-acre field was so badly attacked that not a trace of a plant was left above ground. In addition to its attacks on field beans, the slug often causes much injury to garden beans, lettuce, cabbage, peas, potatoes, radishes, and strawberries. As the species becomes better established in the farms and gardens in new localities throughout New York, it is probable that more widespread attacks may be expected on crops during wet seasons." As a control measure it is recommended that bean plants be "thoroughly sprayed with Bordeaux mixture (4-4-50) to keep the slugs from them. The plants should be sprayed from both above and below, preferably with a potato sprayer having three nozzles to a row. Unless the infestation is severe, this spray should be sufficient. In severe attacks, however, the Bordeaux mixture may be supplemented by a bait of chopped lettuce or clover, 16 parts by weight to 1 part of calcium arsenate powder, the mixture to be scattered around the field. This bait should attack and kill slugs driven from the plants by the Bordeaux."

The asal of cotton and its causes in the Sudan, H. W. BEDFORD (*Wellcome Trop. Research Labs. Ent. Bul.* 17 (1921), pp. 8, pl. 1).—This is an account of a condition of cotton in the Sudan caused by honeydew from the cotton aphid, white flies, etc.

[**Control of orchard insects in northwestern United States**] (*Wash. State Hort. Assoc. Proc.*, 17 (1921), pp. 12-16, 48-53, 56-62, 65-67, 76-79, 83-86, 93-95, 103-106).—The papers relating to insect control presented at the meetings of this association held at Yakima in July and at Spokane in December, 1921, are as follows: The Calyx Spray, by E. J. Newcomer (pp. 12-16); One Year's Experience with Leaf Roller Control Measures, by W. K. Thompson (pp. 48-53); Arsenate of Lead as a Factor in the Control of the Fruit-tree Leaf-roller, by H. E. Newman (pp. 56-62); Orchard Pests in Washington, by C. L. Robinson (pp. 65-67); Some Recent Developments in Codling Moth Control, by E. J. Newcomer (pp. 76-79); The Woolly Aphid of the Apple, by A. L. Melander (pp. 83-86); Codling Moth Results at Wenatchee, by P. S. Darlington (pp. 93-95); and The Blister Mite, by E. J. Newcomer (pp. 103-106).

From experiments conducted, Newcomer concludes that penetration of the lower calyx is not necessary nor very often possible under Washington conditions, and that a fine mist spray from a gun will float into the outer cavity and coat it as effectively as a driving spray from a Bordeaux nozzle.

Thompson reports that in experiments conducted in orchards at Darby, Mont., in 1921, Dormoil applied in the spring at the rate of 8 gal. to 100 gal. of water gave the best results, having killed 73 per cent of the egg masses, which practically amounted to control (see also a note by Seigler and Plank (*E. S. R.*, 45, p. 855)). A miscible oil applied early in the spring will control blister mite as well.

Newman finds arsenate of lead to be of undoubted value in districts like Yakima and Wenatchee, where the leaf roller has not become sufficiently abundant to cause serious loss.

Some important insect pests of strawberries, H. W. MILES (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 16 (1921-22), pp. 57-72, figs. 12).—This account of the insect enemies of strawberries in England includes a key for the identification of the causal insect from the nature of the damage.

Cockroaches, E. McDANIEL (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 38, 39).—In discussing the methods of eradicating cockroaches, it is pointed out that a poison bait that has been used with success in some cases, especially against the large American roach, consists of three cups of linseed meal, cooked up with water until it is about the consistency of thin mush, one cup of molasses (not corn sirup), and one yeast cake softened in a cup of water and per-

mitted to stand until fermentation starts. These are mixed, two tablespoonfuls of arsenate of lead then added, and the material spread on tins and made accessible to the roaches. The use of sodium fluorid, however, is deemed the most satisfactory method of eradication.

Recent experiments with thrips on citrus, J. R. WATSON (*Fla. Grower*, 26 (1922), No. 7, p. 5).—The author reports that a combination of lime sulphur and tobacco is the most efficient insecticide for use against thrips, it being preferred to soap and tobacco because of its greater value against rust mites and red spiders, which often begin to increase about blossoming time. It has been found that in the hands of most spraying crews better killing is secured by the use of a spray gun than with a rod and nozzle. In cooperation with W. W. Yothers, of the U. S. D. A. Bureau of Entomology, tests were made of dusts consisting of lime impregnated with 2.2, 5, and 10 per cent of nicotin sulphate, respectively. Where this material was driven into the blooms with force sufficient to penetrate behind the column of stamens the thrips were killed equally well. It was estimated that between 50 and 60 per cent of the thrips were killed, as compared with 85 or 90 per cent in the case of thorough spraying. While it is as yet too early to form any reliable conclusions as to the practicability of controlling thrips with dust, it has been demonstrated that they can be killed under grove conditions by the use of lime-nicotin dust. It is pointed out that there are five factors to be considered in determining whether spraying for thrips will be profitable, namely, (1) abundance of thrips, (2) amount of bloom, (3) variety of citrus involved, (4) quality of fruit, and (5) possibility of a combination spray.

The cotton thrips (*Heliothrips indicus* Bag.) in the Sudan, with a description of its history and habits in the Gezira (Blue Nile Province) and measures for its control, H. W. BEDFORD (*Wellcome Trop. Research Labs. Ent. Bul.* 18 (1921), pp. 52, pls. 5).—The thrips here considered was first recognized as an important pest in the Sudan during the cotton season of 1918-19, although the native cultivators along the banks of the Blue Nile have recognized it as a pest of their crops for some considerable time. The species appeared in India on indigo at Sirsiyah in Bengal in 1908 and on onions, berseem, and brinjal at Surat in Bengal in 1909. Its food plants include a number and variety of crops and wild plants, but it shows a distinct preference for certain species. Preventive and remedial measures are considered.

Injury to the vine in *Cyrenaica* and *Tripolitania* by a new leafhopper (*Chlorita lybica* n. sp.), E. DE BERGEVIN and D. VITO ZANON (*Agr. Colon. [Italy]*, 16 (1922), No. 2, pp. 58-64, figs. 4).—A leafhopper belonging to the tribe Typhlocybini, which is a source of injury to the grape, is described by De Bergevin as *C. lybica* n. sp.

Artificial production of hopperburn, F. A. FENTON and I. L. RESSLER (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 288-295, fig. 1).—This is a report of experiments conducted during the summer of 1921 in order to observe the effects of the injection of leafhopper extract and of dilute poisons into the leaf tissue, as well as to test out further the results of mutilation of potato leaves.

Control of melon lice or aphids, W. H. GOODWIN (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 7-8, pp. 122-124, figs. 3).—The author describes and illustrates the construction and arrangement of floating spars for the application of Bordeaux mixture and nicotin sulphate, in which way the melon aphids were reached and controlled in the summer of 1921.

Biological studies of *Aphis rumicis* L.: Reproduction on varieties of *Vicia faba*, J. DAVIDSON (*Ann. Appl. Biol.*, 9 (1922), No. 2, pp. 135-145, fig. 1).—This continuation of the work previously noted (E. S. R., 46, p. 246) records the results of observations which show the varying reproductive capacity of

A. rumicis on 18 varieties of field beans. An appendix on statistical considerations involved in the tables presented, by R. A. Fisher, is included. See also another note (E. S. R., 47, p. 55).

Marooned in a potato field, E. M. PATCH (*Sci. Mo.*, 15 (1922), No. 2, pp. 166-180).—The data here presented relating to the potato aphid *Macrosiphum solanifoli* is based upon investigations previously noted (E. S. R., 47, p. 159).

The Hibiscus mealybug, *Pseudococcus hibisci* (Hemip.), W. J. HALL (*Bul. Soc. Ent. Egypte*, 14 (1921), pp. 17-29).—This mealybug, one of the most recent of the Egyptian insect pests, has been responsible for a considerable amount of damage in the Cairo district. It was originally referred to under the name *P. hibisci*, having been considered as new, but has since been identified as *Phenacoccus hirsutus* Green, first described from India and Tasmania in 1908. A brief account is given of its life history and of control measures, with technical descriptions of its several stages. Spraying with paraffin emulsion is said to be effective, but must be accompanied by pruning.

The gloomy scale, Z. P. METCALF (*North Carolina Sta. Tech. Bul.* 21 (1922), pp. 3-23, figs. 15).—This is a detailed report of studies of *Chrysomphalus tenebricosus* Comst., its economic importance, common names, history and synonymy, distribution, host plants, appearance, life history, distribution of its several stages, enemies, and control. The author's studies have led him to conclude that it is useless to try to grow soft maples in the gloomy scale territory unless the trees are sprayed consistently at least every second or third year. The pest is a native of this country and is generally distributed throughout the Southeast, from Maryland to Texas. It attacks many trees, 29 being listed, but is chiefly an enemy of the red and silver maples. "The standard remedy for the gloomy scale is to spray the trees thoroughly once each year, either late in the winter or early in the spring, with a mixture composed of 1 gal. soluble oil to 8 to 10 gal. of water."

A list of 13 references to the literature is included.

Are there two species of the oyster-shell scale? G. H. GRISWOLD (*Ann. Ent. Soc. Amer.*, 15 (1922), No. 2, pp. 184-191, figs. 4).—The study of this insect resulted in the finding of three distinct differences between the so-called apple and lilac forms, namely, differences in the appearance of the scales, in the biological development, and in morphological characters. The apple form was found on red dogwood (*Cornus alba*), alternate leaved dogwood (*C. alternifolia*), round leaved dogwood (*C. rugosa*), and mountain maple (*Acer spicatum*), while the lilac form was found on American ash (*Fraxinus americana*), European ash (*F. excelsior*), fringe tree (*Chionanthus virginica*), golden currant (*Ribes aureum*), laurel leaved willow (*Salix pentandra*), and heart leaved willow (*S. cordata*). A study of the forms in Illinois by P. A. Glenn has been noted (E. S. R., 43, p. 356).

The mulberry silkworm, A. MOZZICONACCI (*Le Ver à Soie du Mûrier. Paris: Libr. Hachette*, 1921, pp. 240, figs. 61).—This is a handbook on silk culture.

The airplane in catalpa sphinx control, J. S. HOUSER (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 7-8, pp. 126-136, figs. 9).—This is an account of *Ceratomia catalpae* Bois. and the manner in which an infestation of a catalpa grove of 4,815 12-year-old trees, from 25 to 30 ft. high, near Troy, Ohio, was successfully treated with arsenate of lead powder applied by means of a Curtiss JN-6 airplane from an altitude of 20 to 35 ft. It is estimated that 99 per cent of the caterpillars present at the time of the application on August 3 were destroyed.

Poisoned molasses for the destruction of noctuid moths, E. H. STRICKLAND (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 214-220, fig. 1).—The annual loss on the western prairies from the destruction of grain crops by the pale western

cutworm (*Porosagrotis orthogonia* Morr.), amounting in recent years to several millions of dollars, has led to the investigations of the value of light traps, molasses troughs, and poisoned molasses here reported.

The results show that "poisoned molasses traps give more promise for controlling noctuid moths than do other methods tried because: (1) They require attention, at the most, once a week, (2) females are attracted as readily as males to bait and they are usually gravid, (3) with a combination of quassia and arsenic very few females that feed on the bait are able to lay eggs subsequently, (4) quassia is nonpoisonous to stock and is distasteful to them, (5) individual traps attract more moths than do corresponding troughs of molasses, (6) all materials are cheap and are readily obtainable anywhere, (7) the bait is effective by day as well as by night and its efficacy is not reduced by moonlight, and (8) climatic conditions affect the traps very little."

The coffee leaf miner (*Leucoptera coffeella* Stain.), G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 52* (1921), *Spanish ed.*, pp. 4-11, figs. 6).—This is a brief account of *L. coffeella*, which occurs throughout the island and is the most important enemy of coffee. Its natural enemies include the parasites *Chrysocharis levida* Ash. and *Zagrammosoma multiligneata* Ash.

Relation of temperature to development of the codling moth, P. A. GLENN (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 193-199).—The results of a study of the relation of climatic conditions to the development of the codling moth, especially to the time of appearance of the several broods of the moth, which are based upon collections made at three localities in Illinois extending through the years 1915-1917, are briefly reported upon.

Studies of the incubation period, based upon observations of 4,175 eggs and reported in tabular form, show the development of the egg to take place only at temperatures above 50° F. and to increase as the temperature rises above that until it reaches 88°, at which point development is at the maximum rate. The results of observations of the effect of temperature on 344 larvae and on 3,817 pupae are also presented in tabular form. They have led to the conclusion that the threshold of development for the larva as well as for the egg is approximately 50° and for the pupae approximately 52°, and that the degree of the maximum rate of development for the egg is about 88, for the larva 85, and for the pupa 87°.

A spray program based upon the relation of accumulated effective day degrees and the time of the appearance of the first larvae of each generation is outlined.

The European corn borer (*Pyrausta nubilalis* Hubn.): Life history in Ontario, H. G. CRAWFORD and G. J. SPENCER (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 222-226).—This is a joint progress report of life history studies carried on at the laboratories of the Dominion and Ontario Departments of Agriculture in the season of 1921 at Port Stanley, Ont.

The spread of European corn borer in southern Ontario, L. S. McLAIN (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 227-231, fig. 1).—This account is accompanied by a map showing the distribution of the pest in Ontario.

The European corn borer control measures, H. G. CRAWFORD and G. J. SPENCER (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 231-236).—This discussion is based upon the joint results of studies in 1921 by the Dominion Department of Entomology and the Ontario Agricultural College.

The European corn borer in New York State, E. P. FELT (*Jour. Econ. Ent.*, 15 (1922), No. 3, pp. 236-240).—A discussion of the present status of this pest in New York State.

Ecdysis in *Tmetocera ocellana* Schiff., S. W. FROST (*Ann. Ent. Soc. Amer.*, 15 (1922), No. 2, pp. 164-168, fig. 1).—A study of the bud-moth is reported under

the headings of the molting process, number of molts, measurement of head capsules, and shape of head capsules.

Natural and acquired immunity in the caterpillar of *Galleria mellonella*, S. METALNIKOW (*Ann. Inst. Pasteur*, 35 (1921), No. 6, pp. 363-377, figs. 5).—In experiments analogous to those made by Paillot (E. S. R., 45, p. 852), the author has found it quite easy to immunize the caterpillar of the bee or wax moth. This is done by injecting a small dose of nonvirulent pneumococci or of pneumococci heated to 58° C. (136.4° F.) into the caterpillar. In 24 hours after the vaccination an immunity against otherwise fatal doses is observed. In none of the cases of acquired immunity studied was the author able to detect the presence of antibodies in the blood. In all cases it was due to the change in the activity and sensitization of the phagocytes.

The artichoke plume moth (*Platyptilia* sp.), E. O. ESSIG (*Calif. Dept. Agr. Mo. Bul.*, 11 (1922), No. 5-6, pp. 454-456, fig. 1).—This is a brief report of observations of a species of *Platyptilia*, the larvæ of which attack artichoke buds or heads in the coast region, Half Moon Bay to Santa Cruz, and in San Luis Obispo County, Calif. There are said to be at least two broods and possibly three or four. Hibernation takes place in the larval stage. While the developing flower buds or heads of the artichoke are the favorite food of the larvae, which eat into the stems or the bracts, they also burrow into the stems near the axils and eat portions of the leaves. In addition to the artichoke, it has been found feeding upon the European milk thistle (*Stilbum marianum*). Means of control are suggested.

The Mediterranean flour moth, H. W. FRICKHINGER (*Die Mehlmotte. Munich: F. J. Böller*, 1918, pp. 63, figs. 16).—An account of the life history, habits, and means for the control of this pest.

The larvae of American *Anopheles* mosquitoes in relation to classification and identification, F. M. ROOT (*Amer. Jour. Hyg.*, 2 (1922), No. 4, pp. 379-393, pls. 2, figs. 3).—This is a report of studies of the larval characters and classification of American species of *Anopheles*.

Notes on mosquitoes and other bloodsucking flies from Porto Rico, F. M. ROOT (*Amer. Jour. Hyg.*, 2 (1922), No. 4, pp. 394-405, figs. 5).—The author, who devoted much time during the summer of 1921 to the collection and rearing of mosquitoes and other bloodsucking flies in Porto Rico, here presents a summary of the previous records from the island.

Notes on certain species of *Melanostoma* (Diptera; Syrphidæ), W. M. DAVIDSON (*Amer. Ent. Soc. Trans.*, 48 (1922), No. 1, pp. 35-47, pl. 1, figs. 3).—The author considers it possible that several species of the syrphid genus *Melanostoma* are both phytophagous and entomophagous in the larval stage, and even that these are undergoing a transition in habit, changing from plant to insect feeders.

Correlation of the life cycle of a parasite with the metamorphosis of its host, N. NOWLIN (*Jour. Parasitol.*, 8 (1922), No. 4, pp. 153-160, pls. 6).—The author here describes what appears to be a clear instance of a correlation of the life cycle of a gregarine parasite, *Schneideria metamorphosa* n. sp., and a mycetophilid fly, *Sciara coprophila*.

Additional host plants of *Oscinella frit* L. among grasses, N. CUNLIFFE (*Ann. Appl. Biol.*, 9 (1922), No. 2, pp. 165-168).—The observations here reported supplement those previously recorded (E. S. R., 46, p. 158.)

A contribution to the knowledge of the bionomics of sand flies, J. WATERSTON (*Ann. Trop. Med. and Parasitol.*, 16 (1922), No. 1, pp. 69-92, pl. 1, figs. 7).—This is a report of observations made in Macedonia of the habitats and habits of sand flies, *Phlebotomus* spp., breeding and rearing them, and preventive measures.

Beetles injurious to sunflowers in Manitoba. N. CRIDDLE (*Canad. Ent.*, 54 (1922), No. 5, pp. 97-99).—Notes are here presented on two of the more important insects attacking the sunflower in Manitoba, namely, the sunflower leaf beetle (*Calligrapha exclamantis*) and the sunflower pith beetle (*Mordellistina pustulata* Melsh.).

The green June beetle. F. H. CHITTENDEN and D. E. FINK (*U. S. Dept. Agr. Bul.* 891 (1922), pp. 52, pls. 10, figs. 7).—This is a monographic account of *Cotinis nitida* L., formerly known as *Allorhina nitida*, based upon a review of the literature and investigations conducted by the authors and collaborators. This beetle is a common and well-known insect in the Eastern States from New Jersey and southern Illinois southward and occurs also somewhat commonly on Long Island, in southern Connecticut, and in the neighborhood of New York City.

The larvae injure vegetables of many kinds, particularly celery, parsley, lettuce, beets, turnips, carrots, parsnips, collards, sweet corn, and peas and beans in the seedling stage. While there is evidence that the larvae injure certain of these plants by severing the roots and young stalks, major injury is due to the upheaval of the soil around the plants, which disturbs the root system. "The grubs are the cause of extensive trouble on lawns and golf greens and do injury also to alfalfa, oats, and some other crops, including ornamental plants. The beetles injure fruits of various kinds, especially grapes, peaches, apricots, and figs, and growing ears of corn, and feed also on the sap of trees.

"There is only one generation or brood of this insect a year. The beetles occur from the middle of June to September and are to be seen in greatest numbers from the middle of July to the middle of August, these periods varying somewhat according to location and temperature. Eggs are deposited from 6 to 8 in. below the surface of the soil and hatch in from 10 to 15 days. After the first molt the larvae feed nearer the surface of the soil. Larvae becomes three-fourths grown by late fall, having molted twice. With the approach of cold weather, they go deeper into the ground, 8 to 10, and even 30 in. below the surface, and continue inactive during the winter, except in mild winter localities where the grubs may be active at any time during warm spells. Early in spring, depending on locality, the grubs again become active until the middle of May, when the larva makes a substantial cocoon, in which it transforms to the pupa. The pupal period lasts 15 to 20 days.

"Many natural enemies of the grubs and beetles, such as birds and certain internal insect parasites and predacious insects, materially aid in the reduction of the pest. Of these, blackbirds, robins, and a large digger wasp are the most effective. For the control of the grubs in cultivated fields, trapping with flowerpots or V-shaped troughs are the most successful. Poisoned baits, prepared in the same manner as for cutworms, scattered on lawns and cultivated fields late in the evening, are also valuable. Kerosene emulsion is an excellent remedy. Flooding is of value on golf links and lawns. Hand methods are employed for capturing the beetles as they occur on fruits and for the larvae on lawns and golf greens."

A list of 45 references to the literature cited is included.

Larval food habits of the Japanese beetle (*Popillia japonica* Newm.). L. B. SMITH (*Jour. Econ. Ent.*, 15 (1922), No. 4, pp. 305-310).—Observations made during the season of 1921 indicate that during the spring and autumn, when most of the feeding is done, live plant tissues constitute between 60 and 70 per cent of the food of the larvae. Previous to this time it had been generally believed that the larvae fed mainly on decaying organic matter in the soil.

The rhinoceros beetles of Porto Rico, G. N. WOLCOTT and F. SEIN, JR. (*Porto Rico Dept. Agr. and Labor Sta. Circ. 58 (1922), Spanish ed., pp. 5-12, figs. 9*).—This consists of brief accounts of the coconut rhinoceros beetle (*Strategus quadriveatus* Beauv.) and the sugar-cane rhinoceros beetle (*S. titanus* Fab.), investigations of which by Smyth have been noted (E. S. R., 46, p. 250).

Longevity of the larval stage of the cadelle, J. W. MCCOLLOCH (*Jour. Econ. Ent., 15 (1922), No. 3, pp. 240-245*).—In studies of the longevity of 26 larvae observed to hatch from eggs, 11 lived an average of 822 days with extremes of 628 and 1,248 days. The length of the prepupal stage was observed in one case to be 9 days, and the pupal stage was determined in two instances to be 12 and 13 days, respectively. The complete life cycle was found in one instance to be 1,085 days, and should a larva which hatched in 1918 and was still alive complete its development, the life cycle would be approximately 4 years.

Further observations on the strawberry rootworm on roses, C. A. WEIGEL and C. F. DOUCETTE (*Jour. Econ. Ent., 15 (1922), No. 3, pp. 204-209*).—This is a report of studies of the life history and habits of *Paria canella* Fab. and of the control of its immature and adult stages, in continuation of an investigation previously noted (E. S. R., 43, p. 362). In control work with the soil stages, in which paradichlorobenzene, sodium cyanid, kerosene nicotin oleate emulsion, orthodichlorobenzene, corrosive sublimate, and tobacco dust and wood ashes alone and combined were used, most of the materials gave negative results, but it is thought that further tests of the tobacco dust and wood ashes may form a basis for the successful control of the soil stages. Since the publication of the account previously noted, hydrocyanic acid gas as a fumigant has been demonstrated to be a satisfactory control measure for the adults.

Ousting the prune root borer, F. H. LATHROP (*Better Fruit, 17 (1922), No. 2, pp. 7, 8, 23, 24, figs. 4*).—In this discussion the author refers to investigations by the Oregon Experiment Station in which it was found that the paradichlorobenzene treatment made use of against the peach tree borer has certain advantages in combating the prune root borer (*Sanninoidea opalescens* Edw.), and at the same time certain limitations which must be overcome to make it thoroughly reliable for use in the Northwest.

A bark borer injurious to cypress in Mexico, J. RIQUELME INDA (*Soc. Cient. "Antonio Alzate" Mem. y Rev., 38 (1920), No. 11-12, pp. 401-405, figs. 2: abs in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 12 (1921), No. 6, p. 792*).—This is a brief account of a beetle of the genus *Phloeosinus* which infests cypress on the edge of the Chapultepec forest, where its excavation of galleries in the cambium has caused the death of trees.

Weevils of the genus *Aplon* injurious to beans in Mexico, H. F. WICKHAM (*Ent. Soc. Wash. Proc., 24 (1922), No. 5, pp. 118, 121, 122*).—Weevils infesting bean plants in the vicinity of Mexico City, Santo Angel, Mixcoac, Atzacapotzalco, and Tacuba represent *A. griseum* Smith and three other unknown species. Small holes were eaten in the leaves, and about 80 per cent of the pods examined were damaged.

The strawberry weevil cutting apple, tomato, and cotton buds in Tennessee, S. MARCOVITCH (*Jour. Econ. Ent., 15 (1922), No. 3, pp. 244, 245*).—The author records injury to apple, tomato, and cotton buds by this pest in Tennessee. Plants used by it for breeding purposes have been found to include the strawberry, blackberry, dewberry, raspberry, yellow-flowered cinquefoil, red-bud tree, rose, and apple. Other plants, like the tomato, horse nettle, and

cotton, may have their buds cut but no eggs deposited in them, and various other plants may be visited by the weevil during their flower period to obtain pollen.

Ips pini Say as a primary pest of jack pine, S. A. GRAHAM (*Canad. Ent.*, 54 (1922), No. 5, pp. 99, 100).—The author records the occurrence of *I. pini* as a primary pest of jack pine in Itasca Park, Minn., during the summer of 1921, although it is normally a secondary insect and usually attacks only dead or dying trees.

On some points of biology and anatomy of the genus Scolytoplatypus Blandf. (Coleoptera, Ipidae), B. BERGER and N. CHOLODKOVSKY (*Rev. Russe Ent.*, 16 (1916), No. 1-2, pp. 1-7, figs. 7).—This is an account of bark beetles of the genus *Scolytoplatypus* in the environs of Vladivostok which attack species of maple.

The beehole borer of teak: A preliminary note on the ecology and economic status of Duomitus ceramicus Wlk. in Burma (Lepidoptera, Cossidae), C. F. C. BEESON (*Indian Forest Rec.*, 8 (1921), No. 3, pp. III+105, pls. 10, fig. 1).—The several parts of this work are as follows: (1) The Previous History of the Pest and Economic Aspects of the Damage, by A. Rodger (pp. 3-23), (2) description of the stages of the insect (pp. 24-32), (3) the life history and habits of the insect (pp. 33-50), and (4) statistical methods (pp. 51-104). A bibliography of 17 titles is included.

Department of entomology (Oklahoma Sta. Rpt. 1921, pp. 22, 23).—The annual white sweet clover commonly known as Hubam sweet clover has been found to be a honey plant of great potential importance. A test made during the spring of 1921 indicates that it will produce a honey flow within three months after planting. Yellow biennial sweet clover begins to blossom as early as April 15 and the white biennial about a week later, and each continues in blossom about two months. Observations of the Russian sunflower as a honey plant show the bees to be fond not only of the nectar but also of the pollen. An initial experiment indicates that the sunflower can be used to good advantage as a honey and pollen plant, as well as a silage plant.

Bee diseases in Ontario, F. E. MILLEN (*Ontario Dept. Agr. Bul.* 276 (1920), pp. 23, figs. 10).—This is an account of the diseases of bees and their occurrence in the Province of Ontario, with directions for treatment. The text of the Canadian Foul Brood Act is included.

Notes on Psithyrus, with records of two new American hosts, O. E. PLATH (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 43 (1922), No. 1, pp. 23-44, pl. 1).—The author finds *Bremus vagans* Smith to be the host of *P. laboriosus* Fab. and *B. affinis* Cress. to be the host of *P. ashtoni* Cress. Previous to the author's studies the hosts of but two of the 13 or 14 species of *Psithyrus* described from the New World had been recorded, namely, *B. flavifrons* Cress. of *P. insularis* Smith by Sladen in 1915 and *B. pennsylvanicus* De G. of *P. variabilis* Cress. by Frison in 1916. Observations of the bionomics of the two additional species, *P. laboriosus* and *P. ashtoni*, are reported upon. A review is given of our knowledge of these species.

"The American *Psithyri* whose habits have been studied rarely, if ever, kill the host queen. A *P. laboriosus* queen which is searching for bumblebee nests never tolerates another *P. laboriosus* queen in the same *Bremus* nest. During the first few days after a *P. laboriosus* queen has gained admittance to a nest of her host, *B. vagans*, the *P. laboriosus* queen intimidates the workers of the colony by rough treatment. After this period of 'getting acquainted,' the members of the *B. vagans*-*P. laboriosus* colony show no more hostility toward each other than the members of an uninfested *B. vagans* colony.

"The *P. laboriosus* queen does not always, if ever, lay her eggs in a pollen mass in which *Bremus* eggs, or larvae, are present, but, like the *Bremus* queen, constructs her own egg cells and, like the latter, attaches them to one or more cocoons. In *Psithyrus*-infested nests of *B. affinis* and *B. vagans* the destruction of the eggs, or young larvae, of the host is probably caused by the *Psithyrus* and not by her offspring. It is not necessary for the *P. ashtoni* queen, and probably also not for other *Psithyrus* queens, to forage for her offspring in order that the latter may thrive.

"The representatives of the genus *Psithyrus* have probably originated from several species of *Bremus* rather than from a single one. Similarity in coloration between *Psithyrus* and *Bremus* species is probably due to genetic affinity and not to 'mimicry or exposure to the same conditions.'"

A list of 34 references to the literature cited is included.

The fowl tick *Argas miniatus*, J. W. PATTON (*Poultry Sci.*, 1 (1922), No. 4, pp. 125-128, figs. 2).—This is a brief summarized account of the fowl tick.

Studies on the taxonomy and biology of the tarsonemid mites, together with a note on the transformations of *Acarapis* (*Tarsonemus*) *woodi* Ren. (Acarina), H. E. EWING (*Canad. Ent.*, 54 (1922), No. 5, pp. 104-113, figs. 3).—This paper deals with the classification of the tarsonemid mites, the mouth parts in the Tarsonemoides, the food plants of *Tarsonemus pallidus* Banks, the feeding habits of *Pediculoides ventricosus* Newp., the transformations of *A. woodi* (Ren.), the transformations of tarsonemid mites, and degeneration and adaptation in parasitic species.

Pollination of red clover by *Tetralonia* and *Melissodes*, J. W. FOLSOM (*Ann. Ent. Soc. Amer.*, 15 (1922), No. 2, pp. 181-184).—Observations and experiments here reported prove that *T. dilecta* pollinizes red clover to an important extent in the latter part of May and in June (in central Illinois), and that *M. bimaculata* also is an efficient pollinizer of plants that bloom during July.

FOODS—HUMAN NUTRITION.

A study of the relation of pectin and acidity in jelly making, L. SINGH (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 8, pp. 710, 711, figs. 2).—In a series of experiments in which jellies were made under uniform conditions from pure pectin solution, pure citric acid, water, and sugar, it was found that with the concentration of pectin kept constant at 1.5 per cent a definite relationship existed between the amount of acid present and the amount of sugar required to form a jelly. Between certain limits (the upper limit being about 2 per cent), the greater the acidity of the juice the lower the amount of sugar necessary. Jellies with a concentration of less than 65 per cent sugar tended to mold, except when poured into sterilized jelly glasses and covered immediately with sterile caps.

A similar study of the relation of pectin concentration and jelling point showed that within the limits of 0.5 and 1.5 per cent pectin the amount of sugar required varies inversely with the percentage of pectin. Above a concentration of 2 per cent the excess of pectin appears to remain inactive or undissolved.

It is also noted that waste lemon peels are rich in pectin, containing over 90 lbs. of pectin per ton of peel.

Is catalase a measure of metabolic activity? S. MORGULIS (*Amer. Jour. Physiol.*, 57 (1921), No. 1, pp. 125-134, fig. 1).—To put to a direct test the theory of Burge previously noted (*E. S. R.*, 47, p. 167) that physiological function is paralleled by catalase activity, the catalase content of frogs kept at widely different temperatures was determined. Since the metabolic activity of

poikilothermic animals is known to vary with surrounding temperature, it was considered that if catalase content is a measure of this activity this would likewise show large differences. Frogs of uniform size and weight were kept for from 48 to 72 hours at different temperatures from 4 to 30° C., after which the whole frog was triturated with sand in a mortar to a fine pulp and catalase determinations were made according to the method outlined in a previous paper (E. S. R., 46, p. 10). This exposure to temperatures which cause changes in the metabolic rate of from 300 to 400 per cent had no influence on the catalase content. "The conclusion is, therefore, unavoidable that whatever the function of catalase in the organism may be it is certain that it is not a measure of metabolic activity."

The distribution of carnosin in the animal kingdom, W. M. CLIFFORD (*Biochem. Jour.*, 15 (1921), No. 6, pp. 725-735).—A study of the quantitative distribution of carnosin in the muscles of various animals is reported. Where possible the colorimetric method described on page 805 was used, but in certain cases the presence of an inhibitory substance made it necessary to isolate the carnosin by successive precipitation of the proteins with lead acetate, mercuric sulphate, etc.

The results of the investigation showed a selective distribution of carnosin in the animal kingdom. All invertebrates gave negative results. Of the vertebrates, all the mammals contained carnosin in varying amounts, but in constant amounts for any given species. No clue as to the physiological significance of carnosin was obtained. There appeared to be no correlation between carnosin content and muscular activity, rate of muscular contraction, or diet.

The effect of cold storage on the carnosin content of muscle, W. M. CLIFFORD (*Biochem. Jour.*, 16 (1922), No. 3, pp. 341-343, fig. 1).—Determinations by the method noted on page 805 of the carnosin content of fresh and cold storage meat are reported, the results of which indicate that there is a much lower carnosin content in cold-storage than in fresh-killed meat. That there is a progressive loss of carnosin on prolonged storage is also shown by determinations of the carnosin content of different portions of a sample of meat taken at intervals of one month from the time of placing in storage. The loss of carnosin was very marked in the first two months, then slight, followed by a greater loss after two or three months. These results were confirmed to a certain extent by determinations of the carnosin content of rats placed in cold storage immediately after death and removed, one at a time, at monthly intervals. The loss of carnosin for the first four months ran parallel with that of beef, after which there was a steep decline until all traces of carnosin had disappeared.

It is thought that the carnosin test may serve as an easy and rapid means of distinguishing between fresh-killed and cold-storage meats, and that it may also be possible by this test to determine the length of time meat has been kept in storage.

Mammary secretion.—III, The quality and quantity of dietary protein. The relation of protein to other dietary constituents, G. A. HARTWELL (*Biochem. Jour.*, 16 (1922), No. 1, pp. 78-105, figs. 7).—Continuing the studies on mammary secretion (E. S. R., 47, p. 62), the author has attempted to find out what proportion of protein can be fed to the mother without danger to the offspring and to determine what other factor or factors should be included in the diet in order that the large quantity of protein may be effectively metabolized. The technique employed is the same as that previously described.

The amount of protein constituting excess for a lactating rat was found to vary with the type of protein and the individuality of the rat. The proportion

of 15 gm. of bread to 1 of protein (egg albumin or caseinogen) in the mother's diet resulted in abnormal symptoms in the litters as noted in a preliminary report (E. S. R., 46, p. 65). On the egg albumin diet the mother lost in weight in one case as much as one-third of her body weight. The harmful effects of excess protein were also obtained when the diet of the mother contained all the essential constituents, vitamins, salts, etc. When the diet was started at birth of the young, some of the litters survived but were not normal. When the diet was begun before or during gestation, none of the young survived. The litters died at approximately the same time, irrespective of the length of time the mother had been on the excess protein diet. The typical symptoms were also induced in the young of rats on a normal diet when transferred to a rat on the excess protein diet.

The high protein diets which proved so harmful to the young proved adequate for growth, fertilization, and reproduction in the rat and were unsuitable only during lactation.

The harmful effects of the diet were entirely obviated by adding 100 cc. of whole milk to the diet. Calcium lactate and milk ash prolonged the life of the young, but the symptoms produced were equally severe. Butter and lactose caused no improvement, but yeast extract (marmite) in large amounts prevented all the bad symptoms in the case of caseinogen and edestin and ameliorated them in the case of egg albumin. The possibility that vitamin B is the factor required for the metabolism of excess protein is suggested, but it is thought that such a conclusion is not justified, particularly on account of the large amounts of the yeast required to overcome the symptoms.

Excess protein and mammary secretion, V. C. VAUGHAN (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 8, pp. 505, 506).—An editorial criticism of the evidence presented in the above paper.

Further contribution to the knowledge of organic foodstuffs with specific action, XI, XII, E. ABDERHALDEN (*Pflüger's Arch. Physiol.*, 193 (1922), No. 3-4, pp. 329-358, figs. 30).—In continuation of the series previously noted (E. S. R., 47, p. 767), two papers are presented.

XI. *Experiments with pigeons* (pp. 329-354).—This paper reports a miscellaneous series of experiments on pigeons, the results of which may be summarized as follows: Pigeons fed yeast pills alone lost weight much more rapidly than starving pigeons. This is thought to afford further evidence that the function of vitamin B is to accelerate metabolism. Pigeons on a polished rice ration proved much more susceptible to fowl diphtheria than normally-fed birds. Heating yeast at 120° C. destroyed its ability to accelerate the loss of weight of starving pigeons, but treating the yeast with chloroform, alcohol, or acetone did not destroy its metabolic effect. Yeast dried at a low temperature remained active for over a year.

The loss in weight of pigeons on a diet of polished rice, previously treated for 24 hours in the cold with 5 per cent hydrochloric acid, could not be prevented by the administration of 0.5 gm. daily of yeast. On supplementing the rice with sugar, the loss in weight was somewhat checked and was still further checked by doubling and trebling the amount of yeast. Attempts to use, in place of yeast, sodium fructose diphosphoric acid, potassium phosphate, formic acid, and various hydroxy-acids gave negative results. The general conclusions drawn are that yeast does not act through supplying known food constituents but accelerates metabolism, particularly the gaseous cellular metabolism through the action of thermolabile substances of unknown nature. These substances are thought to resemble catalyzers in their action.

XII. *A comparative study of the weight and water content of individual organs in pigeons on a normal diet, a diet of polished rice with and without*

added yeast, and during starvation (pp. 355-358).—The heart, brain, lungs, and kidneys of starving pigeons and of those fed polished rice retained their normal weight and water content. The stomach of starving pigeons weighed somewhat less and of avitaminous pigeons considerably less than the controls, and the water content was also lower. The intestines of the controls, while showing a loss in weight of 50 per cent or more, had a water content greater than that of normal, but smaller than that of starving pigeons. The pancreas showed a progressive loss in weight in the avitaminous pigeons, though not so great a loss as in the starving pigeons. The water content was unaltered. The liver showed a similar loss in weight, but the water content was lower than that of normal controls. Pigeons which had been fed for three or four months on polished rice plus 0.5 gm. yeast daily were normal in the weight and water content of the organs examined.

Supplement to the contribution of W. R. Hess on the rôle of vitamins in cell chemistry, E. ABDERHALDEN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 119 (1922), No. 1-3, pp. 117-120).—A criticism of the paper previously noted (E. S. R., 47, p. 168), principally on the grounds of priority.

The rôle of vitamins in cell chemistry, W. R. HESS (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 120 (1922), No. 4-6, pp. 277-280).—A reply to the criticism noted above.

Studies on tissue respiration in avitaminosis, W. R. HESS and N. MESERLE (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 119 (1922), No. 4-6, pp. 176-189).—In continuation of earlier work (E. S. R., 47, p. 168), the respiratory exchange of various tissues of healthy and polyneuritic pigeons was determined by the methods used in the previous study. The results obtained corroborate the earlier conclusion of a decided lowering of respiration in vitamin-deficient tissues and are in agreement with the results reported by Abderhalden with the use of other methods (E. S. R., 46, p. 470). It is noted, however, that in healthy as well as polyneuritic pigeons the extent of respiration differs with different subjects and that this difference should be made the subject of further study.

The potency of commercial vitamin preparations, E. V. McCOLLUM and N. SIMMONDS (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 25, pp. 1953-1957, figs. 10).—A limited amount of evidence is presented that six widely advertised commercial vitamin preparations are worthless as a source of vitamin B. In discussing these results, the authors emphasize the importance of so planning the diet as to include a sufficient amount of vitamin-containing foods and suggests, as a simple rule to follow, that a quart of milk be taken daily, salads twice a day, and potherbs or greens at least once a day.

The distribution of vitamin B in the wheat kernel, M. BELL and L. B. MENDEL (*Amer. Jour. Physiol.*, 62 (1922), No. 1, pp. 145-161, figs. 3).—On account of the diversity of opinion concerning the distribution of vitamin B in the wheat kernel, a further study of this question was undertaken. Mice were used instead of rats as experimental animals on account of their smaller intake of food. The standard diet consisted of a paste food of the following composition: Casein 31, cornstarch 38, salt mixture 7, lard 14, and butter fat 10 per cent. Wheat embryos, when used as the source of vitamin B, were given daily in addition to the basal diet, while the other portions of the wheat kernel which had to be given in larger amounts were incorporated in the basal diet, with a corresponding reduction in the casein and starch supplied.

As standards of comparison, the approximate concentration of vitamin B in the whole kernel was determined for two varieties of wheat, Marquis spring and Minnesota winter wheat. Other materials tested were patent flour, first

clear, second clear, low-grade flour, standard middlings, and bran, these fractions being milled especially for the purpose from a small lot of wheat. In addition, various hand-dissected portions of the wheat kernel were also examined. The results obtained may be summarized as follows:

Of the entire wheat kernel of Marquis spring wheat 10 per cent proved insufficient and 15 per cent sufficient to furnish an adequate amount of vitamin B. Of the Minnesota winter wheat 40 per cent proved to be the minimum requirement for growth. Of the milling products patent flour contained no appreciable amounts of vitamin B, first and second clear about as much as the unmilled grain, low grade flour and bran about twice as much, and standard middlings four times as much as the entire grain. Calculated on the basis of the fraction of the entire kernel represented by each of these milling products, the percentage distribution of the vitamin in the different products is patent flour from 0 to 5, first clear from 15 to 10, second clear 5, low grade 16, middlings 40, and bran 24 per cent.

Of the hand-dissected portions of grains vitamin B was found in both embryo and endosperm, the concentration being several times as great in the former as in the latter and slightly greater in the end of the endosperm nearest the embryo than in the opposite end. Contrary to the results previously reported by Osborne and Mendel (*E. S. R.*, 41, p. 261), no difference could be detected between hand-dissected and commercial embryos. A rough calculation of the percentage distribution of vitamin B in the true structural parts of the grain as distinguished from the commercial milling products is embryo from 8 to 16 per cent, bran 24, and endosperm from 60 to 68 per cent.

In commenting upon these results, it is pointed out that the outstanding fact to be observed is that vitamin B is widely dispersed throughout the entire kernel. The poverty of patent flour in this vitamin is explained as follows:

"In the processes of milling the softer, more friable parts of the endosperm, which are rich in vitamin, adhere to the embryo and bran as they are flaked off from the grain. Harder lumps of endosperm, poor in vitamin, are left behind and when sufficiently freed from germ and bran are themselves ground into fine white flour."

Milk as a source of water-soluble vitamin, III, T. B. OSBORNE, L. B. MENDEL, and H. C. CANNON (*Biochem. Jour.*, 16 (1922), No. 3, pp. 363-367, fig. 1).—The question of the vitamin B content of milk (*E. S. R.*, 43, p. 165) has been made the subject of a further study, in which the experimental conditions reported by Hopkins (*E. S. R.*, 45, p. 567) were duplicated so far as possible. Six rats weighing from 38 to 44 gm. each were fed a basal diet of casein 18, salt mixture 4, starch 54, butter fat 9, and lard 20 per cent, and were each given 2 cc. of milk daily apart from the basal ration. The tests were begun in the fall, the milk being obtained unpasteurized from a near-by supply.

One of the rats died after about 40 days, showing evidence of lack of vitamin B. The others, after an initial period of growth, ceased to grow until the milk was replaced with yeast, either in the form of a fraction prepared by the Osborne and Wakeman method (*E. S. R.*, 42, p. 314) or as dried yeast. The yeast in all cases caused a rapid renewal of growth, thus showing 2 cc. of milk to be entirely inadequate as a source of vitamin B. It is also noted that mixed samples of human milk in quantities of 5 cc. daily furnished insufficient amount of vitamin B for the growth of young rats. When the milk was dried and fed in the form of tablets, the equivalent of 10 cc. of fresh milk furnished a sufficient amount of vitamin B for normal growth.

A note on the relative influence of cod liver oil and butter on the deposition of calcium in the bone of growing rats, S. S. ZILVA (*Lancet [London]*, 1922, I, No. 25, p. 1244).—Reference is made to the paper by

McCollum et al. (E. S. R., 46, p. 471), in which the theory is advanced that, since 1 per cent of cod liver oil proved much more efficient than 20 per cent of butter fat in promoting bone growth in rats, cod liver oil must contain a vitamin distinct from vitamin A. The author is of the opinion that the much higher potency of cod liver oil than of butter in vitamin A is in itself sufficient to explain the results obtained, and calls attention to the fact that, since cod liver oil contains about 200 times as much vitamin A as the average butter, the quantity of butter required to supply the same amount of vitamin A as supplied by 1 per cent of cod liver oil would be too much to be administered.

The vitamin requirement of various species of animals.—III, **The production and cure of xerophthalmia in the suckling**, V. E. NELSON, A. R. LAMB, and V. G. HELLER (*Amer. Jour. Diseases Children*, 23 (1922), No. 6, pp. 518-520, fig. 1).—Striking evidence of the extra need of vitamin A for reproduction and lactation is presented in this continuation of the series of vitamin studies previously noted (E. S. R., 47, p. 169).

Six rabbits, five male and one female, were placed when about three-fourths grown on a diet low in vitamin A, the diet consisting of white corn 55, linseed oil meal 22, oats 15, meal meat tankage 5, and supplementary salt mixture 3 parts. On this diet the animals gained in weight and appeared to be in excellent nutritive condition. After about three months the female gave birth to five young, which she suckled. Soon after the birth of the young the mother began to lose in weight and developed signs of xerophthalmia. Two of the young died before their eyes were opened. One died in a little over two weeks with typical symptoms of xerophthalmia, and the two remaining showed signs of it. On the addition of from 1 to 2 gm. of butter fat to the mother's diet, the xerophthalmia in the mother cleared up slowly and the young showed marked improvement in the eye condition. One had, however, become so weak that it died three days later, but the other began to grow rapidly, doubling its weight in the next 13 days.

B vitamin and pigeon beriberi, W. R. HESS (*Lancet [London]*, 1922, I, No. 11, p. 554).—In reply to the note of Wright (E. S. R., 47, p. 168), the author summarizes the principal conclusions of the experiments discussed.

"The symptoms of B-vitamin deficiency consist in a depression of the energetic processes of the body as shown by the subnormal temperature and muscular weakness in the early stage and the well-known signs of cerebral irritation and paralysis in advanced period. It is to these symptoms in the first instance that apply the conclusions that they are due to loss of oxidative power of the tissues, the insufficiency of the alimentary canal being only a part of the general insufficiency of all tissues.

"The oxidative process of the cell takes place in a series of different stages. There are two main phases of the whole chain of events. The first is given by the reduction of the carbohydrates to lactic acid and the second by the oxidative removal of the formed lactic acid. I think that the disturbance of the chemical reactions in B-vitamin deficiency aims at the second phase.

"The reduction of the oxidative power of the tissues in the vitamin-deficient animal is a fact which can be demonstrated in vitro. And the production of all the main symptoms of beriberi by sublethal doses of prussic acid shows that the reduction of the oxidative power is the cause of the malady and not secondary effect. It is known that prussic acid inhibits the action of the oxidative ferments."

ANIMAL PRODUCTION.

Further observations on the factors controlling fertility and fetal atrophy, J. HAMMOND (*Jour. Agr. Sci. [England]*, 11 (1921), No. 4, pp. 337-366, pls. 2).—In continuing the studies previously noted (E. S. R., 32, p. 465), the number of corpora lutea in the ovaries of pregnant sows, ewes, and tame and wild rabbits were counted as an indication of the ova shed and compared with the number of normal and atrophic fetuses in the uterus. The difference in number was attributed to missing ova. In the case of 80 pregnant ewes examined, 116 corpora lutea and 101 normal and 8 atrophic fetuses were found, leaving 7 ova not accounted for. In 22 pregnant sows examined, 396 corpora lutea, 267 normal and 49 atrophic fetuses were found. This meant that 80 ova had been lost. In the case of rabbits the frequency of occurrence of atrophic fetuses and missing ova was found to be similar to that of pigs.

To study the effect of excessive use of the male on the number of young at birth and the number of lost ova, several experiments with rabbits were carried on in which bucks were mated with does as rapidly as possible for short periods, and the pregnancies and number of young observed. In one case a buck copulated 39 times in about 8 hours. The general results of these experiments indicate that there was no decrease in the percentage of pregnancies or in litter size even during the last copulations.

In studying the effects of uterine nutrition, the conclusions reached were that the average weight of the embryos decrease as the size of the litter increases, that the size of the fetus is roughly proportional to the extent of its membranes, and that the size of the embryo is not dependent on the number lying in the uterine horn. The warm seasons of the year seem to increase the number of eggs shed, but as this occurs the percentage which normally develops decreases. Yohimbine was found to have no effect on the fertility of rabbits. Removing all the corpora lutea in rabbits tends to make all of the fetuses atrophy but never part of them.

An early stage of the freemartin and the parallel history of the interstitial cells, F. R. LILLIE and K. F. BASCOM (*Science*, 55 (1922), No. 1432, pp. 624, 625).—This is a brief report of experiments which showed that the interstitial cells of the male calf appear in the testicle when the embryo is about 3 cm. long, and that this is the time when the male hormone may be first demonstrated in case of freemartins. This occurrence, together with the facts that interstitial cells are absent in the ovary until about the time of birth and the lack of the effect of female blood, indicates that the interstitial cells secrete the sex hormone. The sex differentiation in cattle is apparently due to genetic factors which are intensified by the production of a hormone in the male.

A pseudohermaphroditic cock, C. J. and C. PARHON (*Endocrinology*, 6 (1922), No. 3, pp. 383-386, fig. 1).—The case of a bird is described from the University of Jassy, Rumania, which crowed and laid eggs but never brooded. This bird was a little larger than the average hen, with henlike plumage and a thick heavy comb, wattles, and ear appendages like a cock. An examination of the dead bird showed an abundance of subperitoneal fat, an organ resembling the right testicle but firmer, and a trilobed body which appeared to be a modified left ovary but was hard and bright yellow. A microscopical examination of these two organs showed that they both contained normal and modified testicular tissue. Two apparently normal oviducts were found to be present. The authors state that this is to be regarded as a case of pseudohermaphroditism.

Physiological studies of spermatozoa, G. AMANTEA and K. KRZYSZKOWSKY (*Riv. Biol.*, 3 (1921), No. 5, pp. 569-611).—This is the report of physiological

studies on the spermatozoa of guinea pigs, men, dogs, rats, frogs, and several marine animals, dealing with the effect of sexual rest, the action of various solutions on the length of time that motility could be prolonged and their ability to revive motility after the spermatozoa had formed in clusters, and the action of the temperature on prolonging motility. The solutions used in these studies consisted of Hirokawa's, Ringer's, and Baglioni's solutions, normal salt solution, egg albumin, 0.8 per cent sodium chlorid, fresh water, and sea water.

The studies showed that if sexual rest was too long or too short the resistance of spermatozoa would be reduced. The different animals were variable as to the length of time that they would retain the powers of motility in the different solutions, but it was determined that the cause of the cessation of motility was due to the accumulation of carbon dioxide. Increasing the temperature up to 40–41° C. was accompanied by an increase in the movement, but above this there was a decrease in motility until at 48–50° there was complete cessation of motion. A bibliography of 64 references on this subject is also included.

The survival of motility in mammalian spermatozoa, C. G. L. WOLF (*Jour. Physiol.*, 55 (1921), No. 3–4, pp. 246–248).—Previously noted (E. S. R., 46, p. 673.)

Experimental studies on the duration of life.—I, II, R. PEARL and S. L. PARKER (*Amer. Nat.*, 55 (1921), No. 641, pp. 481–509, figs. 6; 56 (1922), No. 643, pp. 184–187, figs. 2).—In the first paper of the series, entitled "Introductory Discussion of the Duration of Life in *Drosophila*," studies of the duration of life in *D. melanogaster* carried on at the department of biometry and vital statistics of Johns Hopkins University are reported. A review of the literature on this subject is given, with plans for the studies, and a description of the methods of propagating the flies used. Five different strains of flies were available for the tests. In comparing the curves for duration of life of man with those of *Drosophila*, there was found to be a great similarity between them when infancy and childhood in man are discarded and one year is compared with one day in the life of the flies. Tables and graphs are presented showing that the duration of life of certain strains of *Drosophila* is widely different from that of other strains, and that the basis of these differences is hereditary and not environmental.

In the second paper of the series, entitled Hereditary Differences in Duration of Life in Line-bred Strains of *Drosophila*, observations were made by statistical studies on the duration of life of offspring from brother and sister mating in each of several lines. It was found that genetic differences seemed to exist and remain constant in inbred strains for several generations.

Racial investigations.—VII, VIII, J. SCHMIDT (*Compt. Rend. Lab. Carlsberg*, 14 (1921), Nos. 15, pp. 24, figs. 7; 16, pp. 5, fig. 1).—In the seventh paper of this series (E. S. R., 46, p. 268), entitled Annual Fluctuations of Racial Characters in *Zoarces Viviparus* L., data from the experiments previously reported are tabulated. The characters that were mainly considered were the number of vertebrae, the number of rays in the right and left pectoral fins, and the number of hard rays in the dorsal fin.

The results of transplantation experiments and data kept on 10 years' offspring from the same population showed that the variation which occurred in the number of vertebrae had no relation to the variation in the number of rays in the pectoral fins. Comparisons were made of the fluctuation in the right and left pectoral fins in the fish at two different stations from 1915 to 1921, and in the number of hard rays in the dorsal fin from 1913 to 1919. There was found

to be some similarity in the fluctuations during any year, but the outstanding thing was that in the graphs of the pectoral fin rays they were very similar from both stations and frequently overlapping, whereas in the case of the rays in the dorsal fins the fluctuation was much the same in different years, but the results from one station were distinctly lower than those from the other.

In a study of the variation of the number of vertebrae in trout in which some were hatched in running and still water at three different temperatures, the numbers of vertebrae were found to be high at the lowest temperature, falling at the intermediate temperature, and increasing again at the higher temperature.

In the eighth paper, entitled *The Numerical Significance of Fused Vertebrae*, the author discusses the significance of fused vertebrae which are frequently found in fish. It is suggested that the fused vertebrae should be counted as one and one-half. This method is applied to results reported on diallel crosses in trout previously reported (E. S. R., 43, p. 806) to furnish proof in favor of its adoption.

Inheritance of cancer in mice, L. LOEB (*Amer. Nat.*, 55 (1921), No. 641, pp. 510-528).—In studies of the inheritance of cancer in mice, it was found that some strains were very much more susceptible to cancer than others, but that the percentage of mice in one strain dying from cancer kept rather uniform through several generations. Crossing strains of varied susceptibility produced offspring which were in the main intermediate, but in some cases there was evidence of stronger inheritance of the degree of susceptibility or resistance of one or the other parent.

A calorimeter for use with large animals, J. W. CAPSTICK (*Jour. Agr. Sci. [England]*, 11 (1921), No. 4, pp. 408-431, figs. 5).—The description of a calorimeter for large animals at the Institute of Animal Nutrition and School of Agriculture at Cambridge, England, is given. This calorimeter was constructed by remodeling the calorimeter previously described by Hill (E. S. R., 31, p. 764). The results of several observations on men in the calorimeter are also reported.

The Italian method of ensiling hay, F. SAMARANI (*Hoards Dairyman*, 63 (1922), No. 24, p. 806, fig. 1).—This is a description of the method of storing hay in a silo, as is being advocated in Italy. The hay is put in the silo containing about 30 to 40 per cent water as compared with 12 to 14 per cent for ordinary hay. The silo is made so that it can be kept nearly air-tight. The hay is said not to heat, is more palatable and nutritious, and there is less waste from loss of leaves and stems than by the ordinary methods of curing hay. The principle of the preservation of the hay in the silo by this method depends upon the fact that the plant cells in a few hours transform the oxygen in the silo into carbon dioxide which prevents the growth of bacteria and thus does away with the heating of the hay.

Filling silos, J. B. FITCH (*Kansas Sta. Circ.* 95 (1922), pp. 8, figs. 3).—This is a revision of Circular 53 (E. S. R., 34, p. 138).

Palm nut cake and meal (*Ireland Dept. Agr. and Tech. Instr., Spec. Leaflet* 23, rev. (1920), pp. 4).—This gives the guaranteed analysis of oil palm cake and meal, with reviews of experiments previously reported, showing its advantages for feeding cattle, pigs, and poultry.

The breeding and feeding of farm stock, J. WILSON (London: Methuen & Co., Ltd., 1921, pp. VII+152, pls. 8, figs. 12).—This is a general book on breeding and feeding of animals which discusses the subjects mainly from the practical viewpoint.

The importance and breeding of live stock in Catalonia, M. ROSSELL I VILÀ (*Mem. R. Acad. Cien. y Artes Barcelona, 3. ser., 15 (1919), No. 1, pp. 88*).—This work is divided into two parts. Part 1 deals with the economics of live-stock production in Catalonia, showing the number and value of the different classes of animals and animal products produced, imported, exported, and consumed. The live-stock industry is compared with other industries of the country as to the money invested, etc. The types of live-stock production are discussed, especially with regard to the use of more modern methods of breeding.

Part 2 deals especially with the breeding of the different classes of animals, containing chapters on the production of horses, asses, mules, cattle, sheep, goats, and swine. Notes are also included describing the more common diseases of each of these types of animals.

Report of the eighteenth annual meeting of the Corn Belt Meat Producers' Association (*Corn Belt Meat Prod. Assoc. Rpt., 18 (1921), pp. 116*).—In the report of this association are included papers on New Feeding Wrinkles, by C. C. Culbertson; Fundamentals of Cooperative Shipping and Selling, by W. A. McKerrow; Economic Outlook, by E. G. Nourse; Defects in the Prevailing System of Market Distribution, by C. L. Harlan; Cattle Feeding Experiences, by R. A. Gunn; and Farm Finances, by L. A. Andrew; as well as addresses by A. Sykes, H. C. Wallace, R. A. Pearson, and H. Ingham.

Annual for 1920 (*Live Stock Jour. Ann. [London], 1920, pp. 11-222, figs. 45*).—Besides several popular articles on horses and cattle, reviews of the progress made by the different breeds of horses, cattle, sheep, swine, and goats in England during 1919 are given.

On the relative growth and development of various breeds and crosses of sheep, J. HAMMOND (*Jour. Agr. Sci. [England], 11 (1921), No. 4, pp. 367-407*).—In a statistical study of the weights and slaughter records of fat sheep of the British breeds, data taken from the records of the Smithfield Club's Fat Stock Show from 1893 to 1913 are presented. These data include only wethers, and in the case of the live classes records are kept only of the weights, ages, and breeds of the animals, whereas in the carcass classes records are also given of the weights of the carcass, fat, pluck, skin, and that which was unaccounted for after slaughter. In treating the data tables are presented showing for each breed and crossbred according to males and females used the average ages and weights of the sheep grouped in classes over and under 12 months of age, the estimated weekly rate of growth, the average live and carcass weights, and the weight of pluck, fat, skin, and that which was unaccounted for, the estimated weights and percentages of these parts for average 9-months and 21-months-old sheep, relative development of the different parts mentioned at 9 months as compared with 21 months for live classes and carcass classes, the coefficients of variability and standard deviation for all classes, the correlations between the different parts of the body in Southdowns, Suffolks, Hampshires, and Cheviots, changes in live and carcass weights of the sheep during the 21 years, and studies of the effect of the season on growth, as determined by the rainfall, turnip crop, hay crop, etc.

In order to show the changes which had occurred over a period of years, the averages in the tables are shown in many cases for the three 7-year periods, 1893 to 1899, 1900 to 1906, and 1907 to 1913, as well as the total average for the 21 years. This study was based on the following breeds of sheep and crosses between them arranged in order of calculated live weight at 21 months of age, as determined by the author: Lincoln, Cotswold, South Devon, Suffolk, Leicester, Oxford Down, Hampshire Down, Kent, Wensleydale, Dorset Horn, Dorset

Down, Devon, Longwool, Border Leicester, Shropshire, Kerry Hill, Cheviot, Blackface, Ryeland, Southdown, Welsh Mountain, and Exmoor Horn.

A study of inheritance of character in sheep (*Oklahoma Sta. Rpt. 1921*, pp. 16, 17).—A progress report of the experiment in crossing breeds of sheep (E. S. R., 42, p. 372) is given. It is concluded that the possibilities of obtaining a desirable breed by this method seem extremely doubtful, since so many varied and interacting characters have appeared.

Lamb-raising trials at Bathurst, F. B. HINTON (*Agr. Gaz. N. S. Wales*, 33 (1922), No. 4, pp. 239, 240).—In determining the combination of breeds most suitable for the raising of early lambs at the Bathurst Experimental Farm, one flock composed of 106 Lincoln-Merino ewes was mated with 3 Southdown rams, and another similar flock of like number was mated with 3 Dorset Horn rams during a period of 8 weeks. Both lots were then run together. One hundred and four lambs were produced by the Southdown rams, of which 88 lived, as compared with 98 lambs from the Dorset Horn rams, of which 83 lived. In the first lot 36 ewes required assistance at parturition, of which 2 died, whereas in the second lot 29 ewes required assistance and 3 died. When marketed at between 5 and 6 months of age the Southdown lambs brought £81 6s., or 18s. 6d. per head, as compared with £83 17s. 5d. and £1 2s. 3d. for the Dorset lambs. Subtracting 25s. per head for the ewes which died in each lot, the returns are still slightly in favor of the lambs from the Dorset rams.

Effects of alkali and weathering upon the wool of range sheep, J. A. HILL (*Wyoming Sta. Bul. 131* (1922), pp. 3-16).—After summarizing the results of alkali and weathering studies with wool by Hardy previously reported (E. S. R., 39, p. 172), the author reports a series of experiments dealing with the effects of the application of cold 10 per cent solutions of sodium carbonate, sodium sulphate, and magnesium sulphate to growing wool, the effect of protecting fleeces from the weather and dust during a part of the growing period, and the effect of fully exposing fibers to the weather and to the sunlight.

The general results indicated that exposing growing fibers to the action of the weather or the alkalis had practically no effect on the strength of the wool, whereas fibers removed from the sheep and completely exposed to the weather lost one-third of their strength during the first month and were completely destroyed in less than four months. Sunlight seemed to have very little to do with the destruction caused by weathering.

The regain of unwashed wool, J. A. HILL (*Wyoming Sta. Bul. 132* (1922), pp. 35-54).—A series of experiments were carried on dealing with the hygroscopic moisture, or regain, of unwashed wool. In one experiment two samples of unwashed wool were transported by automobile from Laramie, Wyo., to Beltsville, Md., during which time the samples were weighed at intervals and found to have gained from 4 to 5 per cent in weight during the trip. Records of the changes during the day in the weight of samples of pure wool fiber, samples high in fat, high in suint, and high in dirt indicated that the presence of dirt lowers the amount of regain which occurs, and that changes in the humidity make greater changes in the moisture absorbed by the fat and suint. The relative regains of the natural substances in samples of Leicester wool, taking the pure fiber as the standard of 1, were determined approximately for original unwashed wool as $1\frac{1}{2}$ for suint as 2 to $2\frac{1}{2}$, for wool fat as $\frac{1}{2}$ to $1\frac{1}{2}$, and for insoluble dirt (mostly clay) as 1.

In studying the factors which affect the rate of change in the moisture content of wool in storage, it was determined that sudden changes in humidity do not greatly affect stored wool because it is all stored together and little surface is exposed in comparison to the amount of wool stored, and due to the fact that

the warehouses are usually poorly ventilated, the humidity of the air really depends upon the moisture of the wool, whereas wool spread out in thin layers may change rapidly in moisture content, due to the changes in the humidity of the atmosphere.

A bacterial disintegration of wool, J. MACINNES (*Abstr. Bact.*, 6 (1922), No. 1, p. 12).—In this abstract of a paper presented before the Society of American Bacteriologists, a type of bacterial disintegration of wool is reported. The organism causing the disintegration was spore-forming, and from its growth habits and other characteristics it was shown to belong to the anthrax or *Bacillus subtilis* groups.

The British Goat Society's yearbook for 1922, compiled by T. W. PALMER (*London: Brit. Goat Soc.*, 1922, pp. [100], pls. 26).—In this yearbook of the British Goat Society for 1922 are included a number of short discussions of breeds and the improvement, feeding, care, and uses of goats.

A comparison of corn, kafir, barley, darso, cane, and oats for fattening hogs (*Oklahoma Sta. Rpt.* 1921, pp. 15, 16).—Two series of tests are reported in which hogs were fattened on home-grown Oklahoma grains supplemented by tankage to form a ration having a nutritive ratio of about 1:6. The feed in the different rations, designated by the grain they contained, required to produce 100 lbs. of gain during the first test were corn 362 lbs., kafir 391, darso 418, barley 435, and oats 578 lbs., and in the second test corn 306 lbs., barley 374, kafir 375, and cane 392 lbs.

Rations for weanling pigs, L. V. STARKEY and W. D. SALMON (*South Carolina Sta. Bul.* 213 (1922), pp. 8).—In each of two tests 4 lots of 8 and 10 pigs each were fed on rations of 6 parts shelled corn and 1 part tankage, supplemented with 3 parts of red dog flour in lot 1, wheat middlings in lot 2, wheat bran in lot 3, and ground oats in lot 4. The average daily gains made by the pigs for both experiments were for lot 1, 0.83 lb., lot 2, 0.75, lot 3, 0.62, and lot 4, 0.65 lb. per head at respective costs per 100 lbs. of gain of \$6.52, \$6.28, \$7.09, and \$6.87.

[The effect of long-continued feeding of cottonseed meal, linseed meal, and tankage on the number and vitality of the spermatozoa of hogs] (*Oklahoma Sta. Rpt.* 1921, pp. 27-29).—A series of experiments were carried on to determine the effect of rations of corn chop supplemented with cottonseed meal, tankage, or linseed meal on the number and vitality of the spermatozoa of boars receiving these feeds for periods of from 1 to 2 years. Some of the hogs on the cotton-seed meal rations showed the effects of poisoning, became sterile, or died, but the effects on the spermatozoa were not uniform with the different feeds, since some of the hogs on the linseed-meal and tankage rations also became sterile after long periods of feeding, possibly due to the overstimulation of the reproductive organs by the high protein feeds.

Extract of a contribution on the comparative osteology of the horse and the ass with zootechnics of the asinine race, M. ROSSELL I VILÁ (*Deut. Landw. Tierzucht*, 26 (1922), No. 13, pp. 130-134).—Previously reported (*E. S. R.*, 46, p. 875).

Practical dog keeping for the amateur, A. F. HOCHWALT (*Cincinnati: Sportsmen's Rev. Pub. Co.*, 1921, pp. VIII+118, figs. 25).—Included in this book are general instructions for feeding, breeding, and caring for dogs, with notes on conditioning of dogs for shows and field work.

The working dog and his education, A. F. HOCHWALT (*Cincinnati: Sportsmen's Rev. Pub. Co.*, 1921, pp. VII+116).—This book deals mainly with the training of dogs, referring especially to hunting dogs.

Concerning hen feathering, H. D. GOODALE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1920), No. 2, pp. 14, 15).—The author cites evidence

to disprove Boring and Morgan's assumptions (E. S. R., 40, p. 665) that hen feathering in cocks is due to the presence of luteal cells in the testicles.

Physiology of the "stick" in the dry picking of poultry, C. H. KING (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1921), Nos. 7, pp. 55, 56; 9, pp. 65-67, figs. 18).—In studying the physiology of sticking poultry at the University of Wisconsin, 82 broilers and 19 pigeons were killed, part of which were stuck and the brains hardened and later examined to see what portion had been injured. This was correlated with the ease with which the feathers could be pulled, and the location for proper sticking was found to be the medulla. In making this determination some of the birds were also anesthetized, the brain exposed, and certain parts of it injured with a knife or stimulated with electricity. The ease of removing the feathers was again correlated with the portion of the brain injured, and it was also determined that the center for loosening the feathers was located in the medulla. Chloroform, atrophin sulphate, scopolamin, and apomorphin when administered to the birds were found to loosen the feathers as much as sticking but not as much as scalding.

A study of methods of minimizing shrinkage in shell eggs during storage, L. H. ALMY, H. I. MACOMBER, and J. S. HEPBURN (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 6, pp. 525-527).—In this contribution from the Bureau of Chemistry, U. S. D. A., which is preliminary to a study of the cause and prevention of cold storage odor and taste in eggs, the results of experiments on the efficiency of various sealing agents in preventing shrinkage in weight of eggs during storage are reported. The methods and substances used included heating the eggs at 320 and 619° C. for five seconds; immersion in weak solutions of sulphuric acid, orthophosphoric acid, trisodium phosphate, oxalic acid, calcium acid phosphate, sodium aluminate, acetic acid, soap, and dipotassium phosphate at different temperatures and for different periods; immersion in cottonseed, linseed, neat's-foot, and peanut oils for five seconds at 153°, then cooling in the fluid, and wiping dry; and immersion in heavy and light mineral oils with and without soap, gums, waxes, and rosin for seven seconds at 115°, then cooling, and draining.

The general results indicated that the treatments in heated air, weak aqueous solutions of mineral oil or organic acids, and mineral salts or soaps failed to check shrinkage to any great extent. The vegetable and mineral oils, however, markedly decreased shrinkage, especially in the case of the cotton-seed and heavy mineral oils. The addition of from 1 to 2 per cent of soap to the mineral oil was found to render it more effective.

A study of multiple turning of incubated eggs, L. F. PAYNE (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1920), No. 3, pp. 17-20, pls. 2).—The results of several experiments, carried on at the Massachusetts Experiment Station and by poultry raisers, on the frequency of turning eggs in the incubators were found to be rather contradictory. The only conclusions that could be drawn were that more frequent turning in the early spring seemed to show advantages which were not evident later in the season.

Correlation between external body characters and annual egg production in White Leghorn fowls, R. M. SHEZWOOD (*Texas Sta. Bul.* 295 (1922), pp. 3-14).—Observations were made in the fall of 1921 on certain external body characteristics of 128 Single Comb White Leghorn hens hatched during February and March, 1920, to determine if there was evidence of correlation between certain of these different factors or between any of them and annual egg production, which was calculated as the eggs laid from October 1, 1920, to September 30, 1921.

Observations were made on September 20 to 22, 1921, which consisted of classifying the birds according to color of shanks, color of beak, pliability of public bones, handling quality (includes pliability and thickness of skin), width of pelvic arch, capacity (distance from the tip of one public bone to the keel), and depth of body (upper joint of femur to back point of keel), and on October 4, 1921, the birds were weighed and the number of primary wing feathers molted was determined. A summary of the coefficients of correlation obtained, together with their probable errors, appears in the following table:

Summary of correlations for characters studied.

Characters correlated.	Correlation.
Color of shanks and annual egg production.....	-0.622±0.037
Color of beak and annual egg production.....	-.603±.038
Pliability of public bones and annual egg production.....	+.472±.046
Handling qualities and annual egg production.....	+.431±.048
Number of primary wing feathers molted and annual egg production.....	-.522±.043
Body weight and annual egg production.....	+.009±.060
Width of pelvic arch and body weight.....	+.216±.057
Width of pelvic arch and annual egg production.....	+.210±.057
Ratio of width of pelvic arch to weight and annual egg production.....	+.178±.058
Capacity and body weight.....	+.468±.047
Capacity and annual egg production.....	+.093±.059
Ratio of capacity to weight and annual egg production.....	+.100±.059
Depth of body and body weight.....	+.645±.035
Depth of body and annual egg production.....	+.174±.058
Ratio of depth of body to weight and annual egg production.....	+.149±.058
Length of keel and body weight.....	+.384±.051
Length of keel and annual egg production.....	+.208±.057
Ratio of length of keel to weight and annual egg production.....	+.120±.059

The author concludes that there is a distinct correlation, either plus or minus, shown in most cases between what he calls physiological characters (color of shank and beak, molting, pliability of public bones, and handling quality) and annual egg production, whereas there is no distinct significant correlation shown between the egg production and the anatomical characters.

Relative value of certain protein feeds for egg production.—First year's work, 1920-21, R. T. PARKHURST (*Idaho Sta. Circ. 27 (1922), pp. 3-8, fig. 1*).—This is a progress report of the first year's study of the relative efficiency of meat scrap, skim milk, tankage, peas, and combinations of these feeds as sources of protein for egg production.

For this experiment 7 pens of 25 White Leghorn pullets each were used. All pens received a basal scratch ration of 50 per cent of wheat, 25 per cent of corn, and 25 per cent of barley, and a basal mash ration of 60 per cent of wheat bran, 30 per cent of wheat shorts, 7 per cent of alfalfa meal, $\frac{1}{2}$ per cent of salt, and $2\frac{1}{2}$ per cent of charcoal to which was added in pen 1 $1\frac{1}{2}$ lbs. meat scrap to each 5 lbs. of mash, in pen 2 all the skim milk the pullets would drink, in pen 3 $2\frac{1}{2}$ lbs. of tankage to each 5 lbs. of mash, in pen 4 $\frac{1}{2}$ lb. meat scrap to each 5 lbs. of mash and all the skim milk the pullets would drink, in pen 5 no additional protein, in pen 6 6 lbs. of whole peas to each 12 lbs. of grain ration and 4 lbs. of pea meal to each 5 lbs. of mash, and in pen 7 the same as pen 6, with 10 lbs. of skim milk added to 30 lbs. of water to each 18 lbs. of grain and 9 lbs. of mash fed.

The average yearly egg production per pullet in the different pens was, respectively, 145.3, 174.9, 184.2, 159.5, 112.8, 125.4, and 147.4 eggs at the respective costs per dozen of 16.7, 16.9, 16.1, 17.9, 14.5, 16.3, and 12.9 cts. The three lots receiving skim milk were the highest producers, and where a limited amount of milk was fed with peas the cheapest eggs were produced.

A few practical instructions in feeding hens are included.

Cottonseed meal, buttermilk, and tankage as sources of protein of the laying hen, J. H. MARTIN (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1921), No. 5, pp. 39, 40).—This is the report of a study of cottonseed meal, buttermilk, and tankage as the sources of protein for laying hens carried on at the Kentucky Experiment Station from November 1, 1917, to August 1, 1920.

The same basic ration, consisting of 10 lbs. of bran, 10 lbs. of shorts, and 5 lbs. of ground oats, was fed to 4 lots of 25 pullets each, supplemented by the following protein feeds in the different lots: Lot 1 3.2 lbs. of tankage, lot 2 buttermilk ad libitum, lot 3 1.6 lbs. of tankage and 3 lbs. of cottonseed meal, and lot 4 6 lbs. of cottonseed meal. The yearly average egg productions of lot 1 were 109.4, 109.8, and 103.2 per pullet as compared with 114.8, 149.8, and 120.5 for lot 2, 77.7, 86.4, and 79 for lot 3, and 17.5, 23.2, and 22.4 for lot 4, indicating that cottonseed meal is practically worthless as a source of protein for laying hens.

The effects of velvet bean meal upon the health of fowls, B. F. KAUPP (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1921), No. 5, pp. 35, 36, 37-39, pls. 2).—Four years experiments at the North Carolina Experiment Station in feeding velvet bean meal (beans, pods, and vines) and ground velvet beans to baby chickens and fattening broilers are reported.

The rations for the broilers consisted of 45 parts of corn meal, 45 parts of the velvet bean meal or ground velvet beans, and 10 parts of meat scrap. This mixture was fed with water and with milk, but in the case of the meal no gains were made by the broilers, and with the ground beans losses occurred in two of the six pens. Control lots fed similarly with peanut meal instead of the velvet beans made fair gains.

The rations for the baby chickens consisted of 28 parts each of corn meal, ground oats, and velvet bean meal or ground beans, and 16 parts of meat meal with milk and water. In these chicks, fed to 8 weeks of age, the mortality was high, and they did not make good growth. The lots having their feed mixed with milk did better than those getting water, but not as well as the control lots which received wheat middlings in place of the velvet beans.

As a result of the test velvet beans or velvet bean meal as fed in these rations can not be recommended for fattening broilers or for baby chicks.

Effect of certain rations on the efficiency of breeders, G. F. HEUSER (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1920), No. 2, pp. 15, 16).—In comparing a ration of grain with and without green food, when no mash or mash with and without meat scrap or buttermilk was fed for breeding hens, it was found from studies of the feed costs, number of eggs produced, fertility, hatchability, cost per chick, chick mortality, and quality of the chicks that milk and green feeds are highly desirable for breeding hens, and that milk is a better source of animal protein for them than meat scrap.

The nutritional requirements of baby chicks.—II, Further study of leg weakness in chickens, E. B. HART, J. G. HALPIN, and H. STEENBOCK (*Jour. Biol. Chem.*, 52 (1922), No. 2, pp. 379-386).—In continuing the nutritional studies of leg weakness in chickens previously reported (E. S. R., 45, p. 171), the authors report the results of an experiment in which three lots of 19 Rhode Island Reds each were fed on the following rations: Lot 1, 97 parts of white corn, 2 parts of calcium carbonate, 1 part sodium chlorid, and milk ad libitum; lot 2, same mixture as lot 1 plus 50 gm. of cod liver oil per kilogram of ration; and lot 3, a mash of 33 parts bran, 32 parts yellow corn, 32 parts middlings, 1 part charcoal, and 2 parts fish scrap, and a scratch feed of 50 parts yellow corn, 25 parts wheat, and 25 parts oats, and whole milk ad libitum.

At 4 weeks of age 5 birds each from lots 1 and 2 were killed and analyses made for inorganic phosphorus in the blood. At the end of 6 weeks all except 1 of the birds receiving ration 1 had died, either suddenly or after being out of condition for some time. The other died in 8 weeks. All birds in lot 2, except 2 which died at 2 and 4 weeks, made rapid growth and were doing well at 11 weeks of age. Six birds weighing over 200 gm. were transferred from lot 3 to the ration given lot 1. These birds grew well for from 3 to 5 weeks after the transfer, and then they began to fail.

The analysis of the blood showed that the inorganic phosphorus was in most cases present in much smaller amounts in the blood of the birds fed on ration 1 than in blood of those fed on ration 2. The results indicate that chickens require a liberal supply of the vitamins occurring in cod liver oil during the most active period of growth.

Experimental fattening results, [W. A. MAW] (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1921), No. 6, pp. 41-44).—A series of poultry fattening experiments carried on during September and October, 1915, 1916, and 1917, with 42 lots totaling 297 birds, is reported. The birds were separated into lots according to weights, those from 2.5 to 3.5 lbs. being called medium and those over 3.5 lbs. large. The birds were fed on four different rations made up as follows: Ration 1, equal parts of oatmeal, whole buckwheat meal, and corn meal; ration 2, the same as ration 1 plus 10 per cent of beef scrap; ration 3, 36 parts each of oatmeal and corn meal, 18 parts of shorts, and 10 parts of beef scrap; and ration 4, 32 parts each of oatmeal and corn meal, 16 parts of shorts, and 20 parts of beef scrap. Sour skim milk was mixed with each ration in sufficient amounts for ease of feeding.

A summary of the results of the fattening on the different rations for different periods and different sized birds is given in the following table:

Summary of results of fattening chickens.

Ration.	Fleshing period	Number of chickens	Number of lots.	Average initial live weight.	Average final live weight.	Average gain live weight.	Average dressed weight	Dressing percentage.	Quantity of ration to produce 1 lb. of gain in live weight.
	<i>Days.</i>			<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>		<i>Lbs.</i>
1.....	21	36	3	4.520	5.833	1.316	5.222	89.536	11.54
2.....	21	24	3	3.885	5.196	1.281	4.614	89.341	11.41
1.....	14	36	3	4.520	5.645	1.125	.....	.....	9.24
2.....	14	24	3	3.885	4.937	1.052	.....	.....	9.50
3.....	14	42	7	3.94	5.033	1.113	4.526	89.570	7.755
4.....	14	54	9	4.059	5.240	1.171	4.619	88.148	7.395
3.....	10	18	3	4.972	5.902	.930	5.250	86.952	8.010
1.....	10	18	3	4.416	5.312	.895	4.604	87.695	7.276
3.....	14	27	5	3.120	4.351	1.231	3.875	89.059	6.775
4.....	14	18	3	3.125	4.097	.972	3.673	89.650	7.862

The author concluded that the larger birds with a 2 weeks' feeding period did best with ration 4, whereas the medium-sized birds did best on ration 3. The shorter feeding periods of 10 days or 2 weeks seemed to give the best results for the large birds, but the longer feeding periods seemed to result in the best dressing percentages.

[**Poultry fattening at the Oklahoma Station**] (*Oklahoma Sta. Rpt. 1921, p. 25*).—In a 15-day fattening experiment with 1½-lb. broilers, 2½-lb. fryers, and 4-lb. old hens, it was found that the groups made respective gains per bird during the test period of 1 lb. 4 oz., 2 lbs. 11 oz., and 1 oz., with the consumption of 14.75, 21.75, and 20 lbs. of feed, respectively. The losses due to

drawing and dressing were 37.7 per cent for Leghorn and Rhode Island Red broilers, 32.5 per cent for Leghorn and 23.8 per cent for Rhode Island Red fryers, and 44.4 per cent for Leghorn hens.

Controlling pullet production, MR. and MRS. G. R. SHOUP (*Western Washington Sta. Bmo. Bul.*, 10 (1922), No. 3, pp. 52-56).—Practical instructions are given in housing, feeding, and managing young pullets for the best egg production.

[Cost and returns from thirty-nine farm poultry flocks], H. M. ELIOT and E. C. FOREMAN (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 11-15).—Cost and production figures taken by the survey method on the poultry flocks of 39 farms in three counties in the State showed that the returns from these flocks averaged \$1.70 per hen above feed and other direct costs for the year ended March 31, 1922. The average egg production per hen on the farms feeding tankage or skim milk was 96.8, but where neither was fed the average production was only 54.8 eggs. The net returns were, respectively, \$2.59 and \$1.28 per hen.

Housing and feeding of adult fowls, A. LITTLE (*Rhodesia Agr. Jour.*, 19 (1922), No. 2, pp. 200-204).—General information is given on the care, management, and feeding of laying and breeding poultry in Rhodesia.

Poultry conditions in the Philippines, F. M. FRONDA (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb.*, 7 (1920), No. 2, pp. 9, 10).—This is a description of poultry conditions in the Philippine Islands. The methods of handling poultry and the types of birds are described.

DAIRY FARMING—DAIRYING.

The mineral metabolism of the milch cow, E. B. FORBES, J. A. SCHULZ, C. H. HUNT, A. R. WINTER, and R. F. REMLER (*Jour. Biol. Chem.*, 52 (1922), No. 1, pp. 281-315).—After a review of the authors' previous experiments on this subject (*J. S. R.*, 40, p. 373), the results of a fourth series of similar experiments are given.

The objects of these tests were to study the mineral metabolism through the whole period of lactation and gestation in cows, and to determine the value of the particular mineral supplements used, with special regard to the inter-relationships between the elements. The method of study consisted of the complete chemical accounting for feed, milk, urine, and feces during three test periods of 16 or 20 days each with a 10-day or more interval between the periods. Due to unavoidable circumstances, 7 of the tests ran for less than 16 days. The experimental subjects consisted of 6 mature Holstein-Friesian cows in each test, which were in different stages of lactation, as shown in the table.

The rations fed during periods 1 and 2 consisted of alfalfa hay ad libitum and a grain mixture of 13 parts corn meal and 1 part each of cottonseed meal, linseed meal, and wheat bran plus seven one-thousandths as much common salt as grain. One-half of the animals were fed 70 mg. of calcium per kilogram of live weight in the form of a mineral supplement of equal parts of precipitated bone phosphate and precipitated calcium carbonate. During period 3 the grain ration was modified to 5 parts corn meal, 1 part cottonseed meal, and 2 parts wheat bran. Fowler's solution as a source of arsenic was fed to all of the animals during this period, as well as the calcium supplements to one-half of the animals. During the tests the cows were fed and milked four

times daily, watered with distilled water twice daily, and weighed once daily. The results are given in the following table:

Length of test periods, weights, gains, production, period of lactation and gestation, and mineral supplements received.

Per- iod.	Cow num- ber.	Length of period.	Average live weight.	Average daily gain or loss in weight.	Average daily milk yield.	Mineral supplement.	Period of lactation.	Period of gestation.
		<i>Days.</i>	<i>Kg.</i>	<i>Kg.</i>	<i>Kg.</i>		<i>Days.</i>	<i>Days</i>
1	1	20	501	-0.43	19.40	Calcium.....	139-158	49-68
	2	20	531	-0.89	17.18	None.....	142-161	Not bred
	3	20	568	+ .89	.....	Calcium.....	.....	246-265
	4	20	579	+ .17	.....	None.....	.....	240-259
	5	20	440	+ .43	18.43	Calcium.....	55-74	Not bred
	6	20	448	+ .33	22.505	None.....	50-69	Not bred
2	3	7	519	-7.08	21.537	None.....	1-7	Not bred.
	4	5	594	- .50	.....	Calcium.....	.....	275-279
	7	4	404	+ .83	4.441	Calcium.....	Nearly dry.	226-229
	8	16	465	+1.07	.....	None.....	.....	248-263
	9	16	539	+1.65	1.793	Calcium.....	Nearly dry.	182-197
	10	16	514	+1.11	4.525	None.....	Nearly dry.	178-193
3	3	10	467	- .53	24.708	Arsenic.....	30-39	Not bred.
	4	10	488	- .38	27.833	Arsenic and calcium.....	24-33	Not bred
	7	16	493	+1.44	.579	Arsenic and calcium.....	Nearly dry.	250-265
	8	7	493	+1.33	.....	Arsenic.....	.....	273-279
	9	13	575	+1.20	.....	Arsenic and calcium.....	Dry.	209-221
	10	16	546	+1.65	.....	Arsenic.....	Dry.	202-217

Mineral and nitrogen balances.

Per- iod.	Cow num- ber.	Average daily positive or negative balance.							
		Sodium.	Potas- sium.	Calcium.	Magne- sium.	Sulphur.	Chlorin.	Phos- phorus.	Nitrogen
		<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm</i>
1	1	-2.5	-0.3	-5.1	-6.1	-0.6	+2.2	+1.9	+0.2
	2	-1.9	-8.2	-10.1	-5.4	-1.5	+4	-5	-5
	3	-6	-1.8	+7.0	-2.2	+1.4	+1.0	+6.4	+33.2
	4	+4	+7	+6.6	-3.0	+1.8	+3.6	+6.1	+30.6
	5	-1.1	-5.7	-38.2	-9.8	-2.2	+0	-10.5	-5.3
	6	-1.2	-1.6	-7.8	-5.4	+0	+3.1	-1.9	-4
2	3	-10.5	-13.1	-9.6	-2.2	-9.6	-18.1	-15.3	-166.4
	4	+4.1	+9.9	+14.0	+3	+4.0	+6.3	+8.2	+59.7
	7	+10.2	-8.	-1.8	-1.4	+2.8	+3.8	+2.2	+42.5
	8	+2.8	-4.9	+8.2	+0	+3.1	+4.8	+5.4	+19.0
	9	+5.7	+1.6	+8.2	-9	+2.6	+4.4	+5.2	+37.4
	10	+4.7	+15.3	+8.5	-2.1	+3.5	+3.5	+5.4	+52.1
3	4	+4	-2.7	-15.6	-3.6	+0	+2.2	-10.9	+2.2
	7	-1.6	-4.2	-12.3	-1.1	-1.5	-1.4	-6.5	+6.0
	8	+6	+3.0	+7.4	+1.8	-1.7	-8	+5.2	+45.7
	9	+3.5	-7.3	+5.7	-3.1	+1.7	+6.2	-11.8	+6.1
	10	+2.4	-1.4	+6.1	+5	+1.3	+4.4	+1.9	+31.6
			-4.1	+3.8	-7	+7	+1.2	+2.2	+37.6

Among the conclusions to be drawn from this work are that they agree with the results of the previous tests in showing negative calcium balances without exception by cows on dry feeds during the period of liberal milk production. They further show that the cows began to store "calcium as soon as the milk production had decreased to such an extent that the calcium outgo did not exceed their capacities to assimilate calcium and also invariably when they had ceased to produce milk."

The cows receiving Fowler's solution showed no increase in the retention of calcium or other minerals due to the tonic effect of the arsenic. There was evidence, however, of marked but not complete interdependence of calcium and phosphorus metabolism, though phosphorus may be stored during liberal milk

production. A positive nitrogen balance seemed to favor calcium retention to some extent, but considerable independence was evident between nitrogen and mineral metabolism except in case of sulphur, between which there was evidently some relationship.

The milk varied in mineral composition during different parts of the lactation period, it being richer in nitrogen and all minerals except potassium toward the end of lactation. It was further found that when an element was eliminated in large amounts in the milk, the amount of elimination of that element in the urine was usually reduced and vice versa. No arsenic was discovered in the milk of those cows receiving it except in one case where the cow was nearly dry and gave abnormal milk.

Dietary factors influencing calcium assimilation.—II, The comparative efficiency of dry and green alfalfa in maintaining calcium and phosphorus equilibrium in milking cows. E. B. HART, H. STEENBOCK, and C. A. HOPPERT (*Jour. Biol. Chem.*, 53 (1922), No. 1, pp. 21-30).—In continuing the studies at the Wisconsin Experiment Station previously noted (*E. S. R.*, 46, p. 566), dry and green alfalfa were compared as to their efficiency in maintaining calcium and phosphorus equilibrium in the milch cow.

For this test, which began May 11, 1921, 3 Holstein cows (Nos. 1, 2, and 3) were selected which had freshened in December, October, and May, 1920, respectively. Cow No. 1 was with calf and due to freshen in September, 1921, but cows 2 and 3 were not bred. Previous to the start of the test cow No. 1 had received a poor mixed hay (low in calcium) and cows 2 and 3 had been receiving dry alfalfa for the preceding 20 weeks. The test consisted of two periods of 4 weeks each. During the first period the daily ration consisted of 30 lbs. of corn silage, 10 lbs. of dry alfalfa hay, and 1 lb. of grain mixture (60 per cent yellow corn, 25 per cent wheat bran, and 15 per cent oil meal) per 3.5 lbs. of milk produced. During the second period the alfalfa hay was replaced by enough green alfalfa to furnish an equivalent amount of dry matter. The same precautions and methods were employed in determining the calcium and phosphorus balances as in the previous experiments.

In the following table cow No. 1 shows a positive calcium and phosphorus balance on both dry and green alfalfa, but the average daily storage of calcium was considerably greater during the period when the green alfalfa was fed. Cows 2 and 3 showed similar results, but they did not store as much calcium, probably due to the poor ration cow No. 1 received prior to the test:

Calcium and phosphorus balances on rations with dry and green alfalfa during milk production.

Cow.	Weight.		Grain per day.	Week of test.	Milk per week.		Daily calcium balance		Daily phosphorus balance.	
	May 11 (start).	July 5 (end).			First period.	Second period.	First period.	Second period.	First period.	Second period.
	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Gm.	Gm.	Gm.	Gm.
1	1,372	1,468	7	1	160	98	+21.91	+13.36	+20.10	+12.57
				2	151	96	+12.41	+28.71	+23.29	+28.14
				3	137	64	+11.36	+49.21	+19.39	+26.91
				4	122	63	+14.12	+43.48	+8.71	+32.66
				1	238	261	-2.90	+10.62	+25.83	+7.52
2	1,093	1,107	13	2	238	237	+6.30	+9.08	+14.02	+6.88
				3	284	246	+1.10	+22.62	+13.92	+14.91
				4	285	227	+6.02	+4.44	+1.10	+18.47
				1	179	169	-3.35	+8.07	-2.85	+3.88
3	1,284	1,293	9	2	175	139	+0.99	+18.18	+20.23	+16.46
				3	171	128	+2.82	+30.61	+1.91	+10.92
				4	172	128	+7.56	+11.96	+1.86	+10.76

The authors discuss the fact that contrary to other work a positive calcium balance was maintained on dry feeds during milk production and conclude that the possibility of maintaining a positive calcium balance in dairy cows during periods of high milk production depends upon the quality of the carriers of calcium, referring to the amount of destruction through curing, etc., of the unknown factors affecting calcium assimilation.

An interesting note is included on the coagulation of the milk of cow 2. During the period on alfalfa hay this cow's milk coagulated at 136° F., which was prevented by adding calcium salts to the milk. When green alfalfa was fed the milk from this cow still coagulated at 136°, but adding calcium salts was found to lower the coagulating temperature. However, the addition of citrates prevented the coagulation at this temperature.

Sudan grass hay v. alfalfa hay for dairy cows, W. S. CUNNINGHAM (*Arizona Sta. Timely Hints for Farmers*, No. 139 (1922), pp. 4).—Two cows were fed on a ration of corn silage, alfalfa hay, and a grain mixture and compared with 2 similar cows on a ration of corn silage, Sudan grass hay, and the same grain mixture. The lots were reversed each month for a period of 4 months so that each lot received each ration for 2 months during the test. The ration containing alfalfa hay produced in 84 days 520.3 lbs., or nearly 11 per cent, more milk, and 18.1 lbs., or more than 9 per cent, more fat than the ration containing Sudan grass hay.

Feeding dairy cows and heifers, H. E. McNATT (*Western Washington Sta. Bmo. Bul.*, 10 (1922), No. 3, pp. 59–64, figs. 16).—This is a practical discussion of feeding dairy cattle, with special regard to their needs, depending upon whether a cow is with calf, milking, or both.

The effect on the percentage composition of the milk of (a) variations in the daily volume and (b) variations in the nature of the diet, W. TAYLOR and A. D. HUSBAND (*Jour. Agr. Sci. [England]*, 12 (1922), No. 2, pp. 111–124, figs. 4).—In a series of four experiments to study the relation of variation in the volume of milk secreted to variations in percentage composition, the milk from goats was weighed and analyzed when they were on a regular full feed, on full feed but having the feed stopped for two days, and at the beginning and ending of the lactation period. The general conclusions to be drawn from these experiments are that on a diet of constant composition the percentages of protein, casein, albumin and globulin, nonprotein nitrogen, fat, and ash in the milk tend to vary inversely as the daily volume of the milk secreted, and that the percentage of lactose, which is normally quite constant, tends to vary directly with the volume, especially at the beginning and end of lactation.

To determine the effect of the type of diet on the composition and volume of milk, a goat was fed successive rations high in fat, high in protein, and high in carbohydrates for periods of about 2 weeks, with intermittent periods of from 5 to 9 days on normal rations. The composition of the milk was found to change, but in practically all cases this could be explained by an equivalent inverse (except for lactose) change in the volume which occurred with the different rations. However, the nonprotein nitrogen as an exception showed some remarkable variation, from 0.1 to 0.4 per cent, depending upon the amount of protein in the feed. In no case was there an increase in the constituent of the milk corresponding to the type of feed given in excess in the ration.

As explaining the direct proportions found to exist between the amount of lactose and the volume of milk, it is suggested that the quantity of lactose elaborated by the mammary gland may determine the osmotic pressure existing between the blood and the milk and thus control the volume of milk secreted.

The physical analysis of dry milk, R. M. WASHBURN (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 388–398, figs. 2).—This is a description of the physical prop-

erties of powdered milk with reference to the color, texture, odor, taste, and solubility desired, as well as the appearance of the dissolved milk normally and with the addition of Sudan III and hematoxylin stains, cream rising ability, and staining of microscopic slides. The appearance of the milk under the microscope, powdered by different methods and examined by colored slides, as well as by a comparison of the curds of normal and powdered milk during digestion, is also considered. It is stated that milk powdered by the Dick, or Economic, System will dissolve and appear much more like normal milk than that prepared by other methods.

The relationship between the H-ion concentration and the bacterial content of commercial milk. E. W. SCHULTZ, A. MARX, and H. J. BEAVER (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 383-387, fig. 1).—The authors report experiments similar to those previously noted (E. S. R., 45, p. 175), in which the pH value and the bacterial count of a number of samples of market milk are compared. The pH value was mainly determined for these results by Wendt's electro-titration apparatus. As the acidity of the milk increased from a pH of 6.8 to 5.8 there seemed to be a rapid increase in the bacterial count, but for milk of higher acidity the bacterial counts were not uniformly increased.

A note on the Weinzirl anaerobic spore test for determining manurial pollution of milk. J. R. HUDSON and F. W. TANNER (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 377-382, figs. 4).—To determine the validity of the Weinzirl anaerobic spore test under practical conditions, 100 samples of milk were collected at an Illinois milk plant and Weinzirl tests made at the Illinois Experiment Station and compared with the bacterial counts of the cream and the amount of sediment present. From the results obtained it was concluded that there is no relation between the bacterial content and either the amount of dirt or the results of the Weinzirl test. The authors further conclude that the test can not be accepted as a method for accurately determining manurial pollution in milk.

The danger of improperly capped milk bottles, J. G. JACKLEY (*Jour. Dairy Sci.*, 5 (1922), No. 4, pp. 406-411, figs. 2).—In a series of experiments it was found that bacteria on the top of milk bottles capped by the ordinary methods could readily infect the milk when poured from the bottle. Wiping the lips of the bottle with sterile gauze or a dish cloth apparently did not reduce the possibility of contamination by the bacteria, and the dishcloth in some cases seemed to increase or spread the organisms. Rotating the lip of the bottle in a gas flame rapidly while counting from five to eight was found to sterilize this part of the bottle, and is recommended especially during epidemics.

Eighth annual report of the creamery license division for the year ending March 31, 1922, R. L. HAMMOND (*Indiana Sta. Circ.* 107 (1922), pp. 16, figs. 2).—This includes practically the same material as was given in the seventh report (E. S. R., 45, p. 778), with the addition of data reported for the year ended March 31, 1922.

Proceedings of the thirty-sixth annual meeting of the Nebraska Dairy-men's Association (*Nebr. Dairy-men's Assoc. [Proc.]*, 36 [1921], pp. 23-122, pls. 9, figs. 2).—These proceedings of the meeting held at Lincoln, Nebr., January 5 and 6, 1921, consist mainly of several addresses of interest to dairymen.

[Experiments in dairying at the Oklahoma Station] (*Oklahoma Sta. Rpt.* 1921, pp. 19, 20, 21, 22).—Continuation of the experimental work in ice cream making previously noted (E. S. R., 45, p. 476) has warranted several conclusions. The most desirable mix was found to contain 12 per cent butter fat and 34.5 per cent total solids. The total solids in ice cream may be increased

to 38 or 40 per cent by the use of skim milk powder or condensed milk without producing sandiness in storage, but with over 12 per cent of milk serum solids there was danger of producing sandy ice cream.

Experiments in making cheese and the use of different grades of gelatin and tests of gelatin for ice cream making are briefly reported, as well as the ice cream score card used at the station with success.

VETERINARY MEDICINE.

Veterinary ophthalmology, H. JAKOB (*Tierärztliche Augenheilkunde. Berlin: Richard Schoetz, 1920, pp. XI+600, pls. 8, figs. 419*).—This textbook, dealing with the subject at considerable length, includes numerous illustrations, many of which are in colors.

Annual report of the director of animal industry for the year ending November 30, 1921, L. H. HOWARD (*Mass. Dept. Conserv., Dir. Anim. Indus. Ann. Rpt., 1921, pp. 62, figs. 4*).—This report relates particularly to the occurrence of and control work with infectious diseases of live stock, including bovine tuberculosis, glanders, rabies, and hog cholera.

Fourteenth annual report of the State Live Stock Sanitary Board (*N. Dak. State Live Stock Sanit. Bd. Ann. Rpt., 14 (1920), pp. 51, figs. 2*).—This includes a report on Hog Cholera in North Dakota, by W. F. Crewe (pp. 17-24) and on The Intradermal Tuberculin Test, by C. H. Babcock (pp. 25-28).

Report on the civil veterinary department (including the Insein Veterinary School), Burma, for the year ended March 31, 1921, T. RENNIE (*Burma Civ. Vct. Dept. Rpt., 1921, pp. [4]+17, pl. 1*).—The usual annual report (*E. S. R., 44, p. 476*).

Botanical study of the plants poisonous to cattle in Porto Rico, J. MATZ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1921, pp. 55, 56*).—During the year considerable progress was made in gathering suspected plants and propagating them to study their botanical characters and to supply sufficient material for feeding and analytical tests. Mention is made of several of the plants supposed to possess toxic qualities.

The stock-poisoning death camas, C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr., Farmers Bul. 1273 (1922), pp. 11, figs. 6*).—This is a popular summary of information on *Zygadenus* spp., based upon investigations previously noted (*E. S. R., 33, p. 177; 47, p. 181*).

Poisoning in sheep by *Rhododendron ponticum* (var. comm.), K. A. MILES (*Vet. Jour., 78 (1922), No. 566, pp. 300, 301*).—This is a report of the poisoning of six ewes and a yearling ram by feeding on rhododendron, all of which with the exception of one ewe succumbed.

On rhododendron poisoning, S. W. HANDEKAR (*Jour. Pharmacol. and Expt. Ther., 20 (1922), No. 1, pp. 17-44, figs. 5*).—Symptoms of poisoning shown by sheep which had fed on rhododendron leaves led to the investigation here reported. It was found that andromedotoxin, the active principle of rhododendron, acts upon the terminations of the vagus which it first stimulates and then paralyzes, thus explaining some of its most prominent effects. It paralyzes the motor nerve ends in striped muscle. While the paralysis is developing the muscle and nerve are more easily fatigued, but regain their excitability after a period of rest.

“Death from andromedotoxin occurs in two forms: (1) With very large doses it supervenes rapidly and is due to a direct action upon the heart, the ventricles being arrested in diastole or partial systole, and (2) with smaller doses it is due to failure of the respiration through a paralysis of the phrenics

and often of the diaphragmatic muscle also. There is a narcotic action upon the higher centers in the brain; the spinal cord is not affected."

Blood donors in veterinary medicine, L. L'ANISSET and J. VERGE (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 25, pp. 1642-1644).—The authors have attempted to determine whether in horses and cattle a discrimination should be made in the choice of donors before practicing blood transfusion. Using the customary methods for determining the class of donors in human blood transfusion, tests were made with a large number of samples of horse and bovine blood.

The phenomena of agglutination and hemolysis were observed only rarely in horses. In 21 cases out of 171 there was slight evidence of agglutination. The serum of mules agglutinated horse red cells only 4 times out of 23. In the case of recipients which already had had several transfusions, the serum showed both agglutinating and hemolyzing properties for the red blood cells of other horses.

In cattle evidences of agglutination and hemolysis were much more frequent. Certain sera agglutinated all the red cells with which they were tested, even their own. In 15 cases out of 36, intense agglutination resulted.

The conclusion is drawn that the dangers of agglutination and hemolysis are slight in the case of horses, but are considerable in the case of cattle.

Comparative immunity tests with saline vaccines and lipovaccines, J. PRATT-JOHNSON (*Brit. Jour. Expt. Path.*, 2 (1921), No. 5, pp. 232-238).—Various methods of preparing lipovaccines are reviewed, and a new method is outlined in which eugenol is used to dehydrate the bacteria, the eugenol suspension then being added to sterile olive oil. This method and the method of Rosenow and Osterberg (*E. S. R.*, 41, p. 377) were used in the preparation of lipovaccines from a sterile emulsion of hog cholera bacilli. The two lipovaccines and an ordinary saline vaccine suspension of the same organism (killed) were used in the immunization of rabbits. The rabbits, 12 in each series, received 15 million organisms each, this amount being given in one dose in the case of the lipovaccines and two doses of 5,000 and 10,000 million each in the case of the saline vaccine. The immunizing value of the different vaccines was tested by the agglutination titers of the blood serum of the rabbits at different periods after vaccination and also by intravenous injections of 20 M. L. D. of the live organism.

None of the animals survived the test dose, nor did a further series of 6 animals which received an additional dose of 15,000 million organisms. The agglutination titers of the rabbits receiving the different vaccines showed marked variations. Those receiving the saline vaccine gave the best and the eugenol vaccine the poorest results. The second administration of the vaccine, however, raised the titer of the sera in the lipovaccine series to almost as high a figure as in the saline.

These results are thought to point to a lack of association of agglutinin development with genuine resistance to infection by virulent live organisms.

Further studies on the production of immunity in rabbits against an organism of high virulence for the species, J. PRATT-JOHNSON (*Brit. Jour. Expt. Path.*, 2 (1921), No. 5, pp. 239-241).—Following the failure to secure immunity in rabbits against a virulent strain of *Bacillus cholerae suis* by treatment with killed saline vaccines and lipovaccines of the same organism as noted above, an attempt was made to secure such immunity by the inoculation of live organisms of a related type of low virulence, *B. paratyphosus* B, type "mutton," such a possibility having been suggested by Ten Broeck (*E. S. R.*, 40, p. 480).

Three vaccines were employed in the experiments reported, a killed saline vaccine from *B. cholerae suis*, and a killed saline vaccine and a living vaccine from *B. paratyphosus* B, type "mutton." Six animals were employed for each series, and three injections were given at intervals of 7 days, the first subcutaneously, and the second and third intravenously. The doses of the killed vaccines were 2,000 millions, 2,000 millions, and 6,000 millions, respectively, and of the live vaccines 30 millions, 30 millions, and 300 millions. On the thirty-fourth day after the first injection the sera of all of the animals were tested against both organisms and on the following day the inoculated animals received intravenously test doses of the live virulent hog cholera bacillus, the dosage varying from 200 to 1 million organisms.

In the agglutination tests, the animals treated with killed vaccines developed agglutinins for the specific organism only, while those immunized with the living "mutton" vaccine developed agglutinins for both organisms but to a much higher extent for the homologous organism. Of the 6 rabbits treated with the killed hog cholera vaccine, none survived inoculation with the living culture; of the 6 animals treated with the killed "mutton" vaccine, 1 survived; and of the 6 treated with the living "mutton" organism, 3 survived inoculation with the living hog cholera culture. In all fatal cases the organism was recovered in pure culture from the heart blood.

These results are thought to demonstrate "unequivocally the possibility of securing solid immunity against a highly virulent organism by vaccination with live members of a related type of low virulence. So far as this experiment teaches, no very obvious relation exists between survival, amount of test dose, and date of death. With regard to antibody production, the chief point of interest is a possible association of immunity, not with the high agglutinin titers following vaccination with the corresponding killed organism, but with the comparatively lowly titers which have developed in the serum as by-products of the action of a live avirulent but otherwise closely related organism."

Relationship of infectious abortion in swine and cattle, F. B. HADLEY and B. A. BEACH (*Vet. Alumni Quart. [Ohio State Univ.]*, 10 (1922), No. 2, pp. 37-43, fig. 1).—In preliminary investigations the authors found that strains of abortion bacilli of swine origin were capable of producing abortion in pregnant sows and pregnant cows, but those of bovine origin were capable of producing abortion only in cows. This leads them to conclude that there is a biological difference between abortion bacilli from swine and cattle, respectively.

Experiments on the production of a liquid blackleg vaccine, ZSCHOKKE (*Schweiz. Arch. Tierheilk.*, 64 (1922), No. 3, pp. 97-105).—By inoculating cattle subcutaneously in about 20 places with a virulent blackleg culture, the author has been able to obtain peritoneal and subcutaneous exudates to the extent of about 8 liters per animal. These exudates, mixed with 0.5 per cent phenol and filtered through a Chamberland or Berkfeld filter, are germ-free and have proved capable of producing an active immunity against blackleg when injected in doses of from 1 to 2 cc. of the edema filtrate and twice this amount of the peritoneal filtrate. The immunity is said to be acquired in about 10 days and to last for 5 months. The immunity is specific for blackleg and is effective not only against the strain used for the production of the virus, but also against other strains. When kept in the cool and dark the phenolized filtrate retains its activity for about 4 months.

The production and potency of antiblackleg serum, J. P. SCOTT (*Vet. Alumni Quart. [Ohio State Univ.]*, 10 (1922), No. 2, pp. 47-53).—A brief description is given of the intravenous and subcutaneous methods of obtaining

antiblackleg serum, and data are presented showing the variation in different horses in the ability to produce potent serum, and the remarkable keeping qualities of the serum. Serum which, when produced in 1917, had a potency of 111 antiblackleg units had a strength of from 70 to 100 units in 1921.

The duration of the contagious period in foot-and-mouth disease, C. LEBAILLY (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 24, pp. 1580-1582; also in *Rec. Méd. Vét.*, 98 (1922), No. 15, pp. 429-431).—By exposing susceptible cattle to others suffering from foot-and-mouth disease at different stages of the disease, it was found that the period of greatest contagion was from the time of the first rise in temperature to that of the rupture of the aphthae, that is from the end of from 48 to 72 hours after the infection to about the fourth day after the appearance of the first vesicles. During the later stages of the disease attempts to infect other animals failed. The author concludes that sanitary measures applied when the epidemic is well under way are of no use, but that the only means of checking an outbreak consists in keeping a close watch on the individual animals and isolating them in the first stages of the disease.

The contagiousness of foot-and-mouth disease, H. VALLÉE and H. CARRÉ (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 5, pp. 292-294).—The authors confirm the above conclusions of Lebailly, but call attention to the fact that in a number of cases animals cured of the disease have apparently transmitted the disease several weeks later. This is attributed to the preservation of the virus in the cleft of the hoof and in lesions under the hoof. It is, therefore, considered necessary to keep infected animals in quarantine for at least 15 days after recovery.

Studies of biological preparations by complement-fixation methods.—**I, Mallein:** Antigenic variations and a proposed method of standardization, E. A. WATSON and L. M. HEATH (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 5, pp. 503-514, fig. 1).—As a method of standardizing biological preparations, the authors suggest the use of the complement-fixation test which enables the strength and activity of the preparation to be expressed in terms of units of antigen and units of antibody. In the method as applied to mallein, the antiserum is obtained by the hyperimmunization of a healthy horse to mallein. Experiments are reported which show that the horse is easily sensitized to mallein and furnishes an antimallein or sensitizing serum of high titer. The immunity thus secured is not lasting, the number of antibody units gradually diminishing in about 30 days after the last injection. Further injections of mallein will, however, restore the immunity.

Tests of the specificity of the antimallein serum showed that there was no fixation of complement when the antigen employed was tuberculin, blackleg filtrate, glycerin bouillon, or other culture media tested, thus pointing to the specificity of the serum.

Rabbits were found unsuitable for the production of a specific antiserum for complement-fixation tests in which a rabbit-antisheep hemolytic system was employed, nonspecific reactions being the rule. It is emphasized on this account that in all complement-fixation tests the three animal species represented by the complement, red cells, and sensitizing serum of the hemolytic system should not include the animal species represented by the test serum.

The system employed for determining either the reactivity of an antiserum or a mallein and for computing the number (N) of units in a given volume (V) of either reagent is stated as follows: "The minimum amount (M) of the one which, in the presence of an excess but noninhibitory amount of the other, will fix one unit of complement is said to be a single active unit. The amount of a

given volume of reagent divided by the amount represented in a single unit will give the total number of units $\left(\frac{V}{M-N}\right)$."

Determinations by this method of the units of antigen in a diagnostic dose of mallein are reported for seven samples of liquid mallein and three of ophthalmic mallein disks. The data show a marked variation in activity in the different malleins, the number of units in a recommended diagnostic dose varying from 0 to 1,250.

Alternate freezing and thawing of mallein was found to have no effect on its antigenic value or reactivity.

The identity of American and French sporotrichosis, D. J. DAVIS (*Wis. Univ. Studies Sci. No. 2, (1921), pp. 104-130*).—This is a summary of information on the subject. The author concludes that *Sporotrichum beurmanni* and *S. schenckii* are synonymous, and the organism should be known by the latter name.

The resistance of different hosts to experimental trypanosome infections, with especial reference to a new method of measuring this resistance, W. H. and L. G. TALIAFERRO (*Amer. Jour. Hyg., 2 (1922), No. 3, pp. 264-319, figs. 18; abs. in Vet. Rec., n. ser., 2 (1922), No. 39, pp. 729, 730*).—This is a report of studies in which experimental infections were made with *Trypanosoma lewisi*, *T. equiperdum*, and *T. equinum* in the rat; *T. brucei* in the dog, mouse, and guinea pig; and *T. rhodesiense* in the rat, mouse, dog, and guinea pig.

The relative parasitical value of arsphenamin and neoarsphenamin, with a description of the trypanocidal test, C. VOEGTLIN and D. W. MILLER (*Pub. Health Rpts. [U. S.], 37 (1922), No. 27, pp. 1627-1641*).—This is a report of tests in which rats infected with the dourine organism (*Trypanosoma equiperdum*) were employed. The results of the investigation confirm those of an earlier work, namely, that arsphenamin of different manufacture is fairly uniform in parasiticidal power, whereas neoarsphenamin shows great variations.

Immunology of tuberculosis, A. F. SCHALK (*Vet. Alumni Quart. [Ohio State Univ.], 10 (1922), No. 1, pp. 1-14*).—A review of the literature on attempts which have been made to immunize cattle against tuberculosis.

Palpebral tuberculinization in cattle, W. ILGNER (*Berlin: Tierärztl. Wehnschr., 38 (1922), No. 26, pp. 301-303*).—German literature on the palpebral or lid test for bovine tuberculosis is reviewed briefly, and the author's experience in the use of the test is reported.

It is concluded that the palpebral test applied either subcutaneously or intracutaneously is more satisfactory than the ordinary eye test. With a little practice the test can be made quickly and easily, and the results can be interpreted readily, particularly in the intracutaneous test. It is emphasized, however, that differences are to be expected in the reaction, depending upon the age, constitution, and breed of the cattle and upon the type of tuberculin used.

Technique of tuberculin testing, H. W. TURNER (*Jour. Amer. Vet. Med. Assoc., 61 (1922), No. 6, pp. 636-646*).—Detailed directions are given for the administration of, and interpretation of results in, the subcutaneous, intradermal, and ophthalmic tuberculin tests alone and in double and triple combination.

Immunization against mouse typhoid through feeding, O. ORNSTEIN (*Ztschr. Hyg. u. Infektionskrankh., 96 (1922), No. 1, pp. 48-69*).—Attempts to immunize mice and guinea pigs against mouse typhoid through the feeding or subcutaneous injection of living organisms or of the same killed by chloroform

are reported in considerable detail. Active immunization of mice against virulent strains of the paratyphoid group was secured with difficulty and only occasionally. The degree of immunity appears to be dependent upon whether a subchronic infection is induced or not. If conditions are favorable for changing the acute infection into a chronic form, later feeding of the organism as a rule has no ill effect. Better results were obtained with mice by feeding the killed cultures than by injecting them subcutaneously.

In guinea pigs, which are less susceptible than mice to infection with virulent cultures of mouse typhoid by feeding, such feeding more often causes a light form of the disease which protects the animals against further infection. This protection is more easily secured against infection through feeding than by peritoneal injection. It is concluded that a relatively high immunity is obtained only through surviving an infection. A chronic infection produces, through long continued reciprocal action between organism and infective agent, this relative balance, i. e., immunity.

Parasitology (*Oklahoma Sta. Rpt. 1921, pp. 29, 30*).—In experimental work several chicks that were fed large numbers of roundworms (*Ascarida perspicillum*) died of pneumonia in 8 to 10 days, it having been caused by the migration of larvæ from the intestine through the various organs and finally to the lungs.

Recent experiments with lungworms in sheep have furnished information on their life history additional to that previously recorded (E. S. R., 43, p. 79). In gross experimental infestation of a lamb with larval lungworms, an autopsy revealed their presence in nearly every organ in the body, but more especially in the blood stream, where they were being carried to the lungs. "The mesenteric lymph glands were much enlarged. Examination of the blood before lung symptoms appeared gave negative results. In all probability the larvæ do not enter the blood at once but remain in the mesenteric lymph glands for some time before entering the blood. The presence of larvæ in other organs may be due to the circulation. A subcutaneous injection, consisting of several hundred larval lungworms in physiological salt solution, given to a lamb gave negative results."

Acute contagious encephalitis of bovines, A. DONATIEN and R. BOSSELOT (*Rev. Gén. Méd. Vét., 31 (1922), No. 364, pp. 185-191*).—This is an account of an apparently new disease which attacked herds of cattle between September 10 and November 5, 1921, at a farm in the Department of Algiers. The authors' investigations have demonstrated the presence of a virus that has a particular affinity for the nerve centers. This virus has some resemblance to that of rabies but is sufficiently different to be considered a distinct organism.

Contribution to the study of the piroplasms of bovines, E. LAGRANGE (*Bul. Soc. Path. Exot., 15 (1922), No. 5, pp. 295-299*).—A report of studies in Indo-China.

Textbook of diseases of the sheep, T. OPPERMAN (*Lehrbuch der Krankheiten des Schafes. Hannover: M. & H. Schaper, 1921, 2. ed., pp. XVI+387, pls. 40, figs. 35*).—This work deals with the various diseases of sheep, mineral and plant poisoning, feeds, castration, etc.

Some milk goat problems observed in California, W. D. PIERCE (*Calif. Dept. Agr., Div. Anim. Indus. Spec. Pub. 22 (1922), pp. 12*).—This account is based entirely upon personal observations made by the author in San Mateo County during the year previous to its preparation, when he was called into consultation because of the death of a large number of goats from head bots. The parasites discussed include the goat head or sheep bot (*Oestrus ovis* L.), the goat nodular worm, *Oesophagostomum venulosum* (Rud.), several species of flies, sucking and biting lice, and nematodes.

The best measure for the control of the sheep bot is said to consist in the treatment of the noses of the goats during the entire season of bot fly attack with a mixture made in the proportion of 1 pint of pine tar to 1 oz. of oil of eucalyptus. This can be done easily by brushing the nose of each animal as it leaves the pen. Some goat raisers make it a practice to grease the boards above the feeding racks with the mixture, so that as the goats feed they will grease themselves.

Bacterium suisepiticum as a factor in pneumonia of swine, R. R. BIRCH and J. W. BENNEB (*N. Y. State Vet. Col. Rpt.*, 1920-21, pp. 143-172).—The authors' investigations indicate, in common with those of other investigators, that *B. suisepiticum* is a specific cause of swine plague or hemorrhagic septicemia. In the vicinity of Ithaca it may occur exceptionally as a primary disease and, judging by field observations, it occurs frequently as a complication.

"Our results so far do not indicate that a solid immunity against the activities of *B. suisepiticum* can be conferred by the methods of vaccination we have used, that is, repeated subcutaneous doses of suspensions of the highly virulent organism did not give complete protection against subsequent intravenous doses of like suspension. It is thought by some investigators that there are many varieties of *B. suisepiticum*. Our experience leads us to believe that there is one variety which fluctuates rapidly and strikingly in character, especially in virulence."

Frequency of iodophil Amoebae in swine in France, L. CAUCHEMEZ (*Bul. Soc. Path. Exot.*, 14 (1921), No. 6, pp. 321, 322, fig. 1).—The organism, found by Wenyon in human stools in 1915, for which the name *Iodamoeba wenyoni* was proposed by Brumpt in 1921, was found by the author in 8 out of 37 pigs from various parts of France that were examined within a period of three days at the Paris abattoir and in 4 out of a later series of animals. The true proportion is thought to be from 50 to 60 per cent.

The care of the horse: Hygiene and diseases, P. F. LÉVÊQUE, H. MAMMELLE, and L. J. PONSCHARME (*Les Soins à Donner au Cheval, Hygiène et Maladies*. Grignon, France: *Libre du Cultivateur*, 1919, pp. 448, figs. 163).—This handbook deals particularly with the affections of the horse.

Equine epizootic lymphangitis, B. BANG (*North Amer. Vet.*, 3 (1922), No. 8, pp. 418-424, figs. 3).—The author gives an account of observations of this affection and records its occurrence for the first time in Denmark.

A contribution to the study of the treatment of epizootic lymphangitis, E. LARIEUX (*Bul. Soc. Cent. Méd. Vét.*, 98 (1922), No. 6, pp. 131-136).—The author reports that of 31 horses affected with cryptococcic lymphangitis, vaccination by the method of Boquet and Nègre cured 67.7 per cent.

On epizootic lymphangitis, BROCC-ROUSSEU (*Rec. Méd. Vét.*, 98 (1922), No. 4, pp. 84-91; *abs. in Trop. Vet. Bul.*, 10 (1922), No. 2, pp. 53, 54).—The author reports that in collaboration with Matruchot he has been able to demonstrate a conidial form of the parasite of epizootic lymphangitis.

Preliminary report on equine botulism in Canada, C. A. MITCHELL (*Jour. Amer. Vet. Med. Assoc.*, 61 (1922), No. 6, pp. 609-619, fig. 1).—From the contents of the stomach, small intestine, cecum, and colon of a horse which had died of so-called cerebrospinal meningitis, an organism culturally identical with *Bacillus botulinus* was isolated. This organism formed a toxin which was identified in the usual manner as belonging to type B and which induced typical botulism in a horse when administered orally. The toxin did not become fixed to healthy brain tissue in vitro even after incubation at 37° C. for five hours. It proved capable of precipitation with 95 per cent alcohol without loss of activity. Chickens proved immune to the toxin even when fed massive

doses. Eggs laid by hens which had been fed the toxin showed no evidence of containing the toxin.

To determine whether the toxin could be produced in vegetable media, oats were sprouted and the sprouts washed in sterile water, packed in a large test tube, inoculated with *B. botulinus*, and incubated anaerobically at 28° for 10 days. Smears from the inoculated tubes showed the presence of *B. botulinus*, and the liquid caused fatal botulism in guinea pigs.

"This clearly indicates that *B. botulinus* may grow in fodder and produce its toxin. Clinical experience would rather indicate that not the whole mow full of hay is infected, but that the bacillus grows here and there, producing pockets of infective material. When the hay from one of these pockets is removed and fed, the illness is set up and only the animals receiving fodder from these local areas are infected. The herd will remain quite healthy until another pocket is fed, when the illness will again appear."

An outbreak of botulism in chickens, I. E. NEWSOM (*North Amer. Vet.*, 3 (1922), No. 8, pp. 455, 456, fig. 1).—Cans of home-prepared corn showing signs of spoilage were fed to a flock of 200 hens at about 11 a. m., and signs of illness were observed about two hours later. Eight or 10 soon succumbed to the affection, and by the next morning 78 had died, including all of about 60 that had been operated upon to remove the corn from their crops. In examinations made by three different laboratories, all detected the presence of *Bacillus botulinus*, type A.

Infectious leukemia of chickens (pseudoleukemia, anemia, etc.), with a contribution to the normal hematology of the chicken, V. ELLERMANN (*Die Übertragbare Hühnerleukose (Leukämie, Pseudoleukämie, Anämie u. a.) mit Beiträgen zur Normalen Hämatologie der Hühner*. Berlin: Julius Springer, 1918, pp. VI+82, figs. 13).—The several chapters of this contribution deal, respectively, with (1) history of the study of leukemia (pp. 1-6), (2) notes on technique (pp. 7-11), (3) the normal blood of the chicken (pp. 12-16), (4) the blood-forming organs and tissues of the healthy chicken (pp. 17-21), (5) the leukemia virus (pp. 22-31), (6) the elements of leukemia (pp. 32-41), (7) clinical types, including lymphatic leukemia, atypical lymphatic cases, intravascular lymphoid leukemia, myeloid leukemia, and anemic leukemia (pp. 42-61); (8) change of types within the experimental strain (pp. 62-64), and (9) conclusions. A protocol of the experiments is appended (pp. 67-81), and a list of 18 references to the literature is included.

The why of our heavy losses of growing fowls, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 3, pp. 56-59).—The author reports that at least 90 per cent of the unusually large number of growing fowls brought to the veterinary department of the station during the few months previous were found to be affected with various kinds of intestinal parasites. The method of dealing with this condition is considered at some length.

A comparative study of the giardias living in man, rabbit, and dog, R. W. HEGNER (*Amer. Jour. Hyg.*, 2 (1922), No. 4, pp. 442-454, figs. 14).—The author's observations confirm opinions expressed by several previous investigators that the rabbit is parasitized by a species distinct from that living in man.

RURAL ENGINEERING.

Duty-of-water investigations on Coal Creek, Utah, A. FIFE (*Utah Sta. Bul.* 181 (1922), pp. 3-22, figs. 11).—The results of five years irrigation investigations on the net duty of water under Coal Creek, Iron County, Utah, conducted under a cooperative agreement between the U. S. Department of Agriculture and the station, are reported. The primary purpose of this investigation was to establish a scientific basis for the distribution of water to the various users.

Increasing the use of water to a depth of 70 in. for alfalfa on land having primary water rights increased the yields. Under secondary rights the capacity of the soil to hold moisture for late crop growth was found to be the most important single factor in the determination of an economical use of water. The net duty for grain ranged from 20 to 40 in. Where uniform lateral distribution was difficult to obtain, the requirement was high. Little more than 24 in. of water was necessary for potatoes.

It is concluded that improvements in land preparation and in methods of irrigation to obtain a uniform lateral distribution of water offered the greatest opportunity for increasing efficiency in the use of water. An immediate limitation of water applications to the amounts shown by the experiments to be necessary is considered neither desirable nor feasible. The adoption of a water distribution policy that will reward skillful and intelligent users and will penalize those using careless methods is recommended as a proper procedure pending the attainment of the ultimate goal of having the water used on a truly economical basis.

Growing irrigated crops in Harney Valley [Oreg.], O. SHATTUCK and D. W. RITCHIE (*Oregon Sta. Bul. 191 (1922), pp. 24, figs. 15*).—The results of investigations conducted on the soils in the Harney Valley of Oregon to determine the crop adaptations, water requirements, proper crop rotations, fertility requirements, and the possibilities of irrigation by pumping are summarized in practical form. Yield data are included for wheat, barley, oats, rye, alfalfa, field peas, clovers, sunflowers, potatoes, sugar beets, and mangels, and for various rotations. Deductions are presented for practical use by irrigation farmers.

The border system of irrigation is considered to be one of the best, while the check system is not recommended for Harney Valley conditions. The corrugation system is said to be well suited to land sloping in different planes, and the furrow system is well adapted to the irrigation of row crops. Subirrigation can be used to advantage on grain and alfalfa where soil conditions permit. Flooding has been found to be a wasteful method of irrigation.

Alkali water for irrigation, F. S. HARRIS and N. I. BURR (*Utah Acad. Sci. Trans., 2 (1918-1921), pp. 87-94*).—In a contribution from the Utah Experiment Station a summary of information on the use of alkali water for irrigation is presented. It is stated that Utah waters are troubled mainly with sodium chlorid and sodium sulphate. Most of the waters of the State contain such small quantities of alkali salts that they are classified as good under ordinary conditions.

The results of pot studies on different soils are presented which have been previously noted (*E. S. R., 42, p. 276*).

Plants growing in soil containing sodium carbonate were very wasteful in the use of water, while those in soil containing sodium chlorid were more economical. The size of the leaves in the loam soil decreased as the strength of the solution increased. Mixed salts appeared more toxic to the length of leaves and number of heads per plant than the single salts.

The length of culture did not appear to be so closely related to alkali as to other factors, either in loam or in sand soil. In general the number of spikelets per head decreased with increasing strengths of alkali. The weaker alkali, especially sodium chlorid and mixed salts, apparently stimulated the production of spikelets. The salts did not seem to be quite so toxic to the plants at a given concentration and time in the sand soil as in the loam soil.

An experiment with seedling plants showed the average order of toxicity for the different salts to be sodium carbonate, sodium chlorid, magnesium chlorid, calcium chlorid, and sodium sulphate. Solutions containing less than 60,000

parts per million of sodium chlorid apparently stimulated dry matter production in seedling plants. Sodium chlorid was slightly more toxic to growth in height of seedlings than other salts, and sodium sulphate distinctly favored this development. With the weaker strengths of alkali the plants withstood sodium chlorid better than sodium carbonate, but when the stronger solution was applied the plants were killed at an earlier stage with sodium chlorid than with sodium carbonate.

These results are taken to indicate that the stage of growth reached by the plant before the alkali is brought into contact with it has considerable influence on the injury that will be done to it.

Experiments on air lift pumping, J. S. OWENS (*Engineering* [London], 112 (1921), No. 2908, pp. 458-461, figs. 9).—This paper discusses the causes of loss of efficiency in air lift pumps and possible remedies, reports experiments made to elucidate causes of loss and to obtain data for improvement, and describes a special air lift pumping installation. The sources of loss discussed are slippage, friction, kinetic energy of discharge, and submergence. The experimental work deals with the relation of diameter of bubble to velocity of rise through water and the conditions governing the size of bubbles, the effect of surface tension, and the oscillation of bubbles. From these results formulas and tabular and graphic data covering design and operation are deduced.

Core walls for earth and rock fill dams, C. H. HOWELL (*Reclam. Rec.* [U. S.], 13 (1922), No. 8, pp. 197-200, figs. 2).—Brief general information is given on the construction of core walls for earth and rock fill dams for use in irrigation, and sections of such structures used in Reclamation Service dams are described and illustrated.

Clearing cut-over lands in Baldwin County [Ala.], E. C. EASTER and M. L. NICHOLS (*Alabama Col. Sta. Circ.* 45 (1922), pp. 4).—This is a brief report of progress on land clearing and wood distillation investigations in Baldwin County, Ala. The blasting and combination of pulling and blasting methods of land clearing were compared. The blasting method requires less initial investment and can be used more economically in removing scattered stumps. Its operation is expensive, and the results are less efficient. The combination method has the advantages of cheaper operation and more efficient results. The initial cost is greater, which becomes a greater disadvantage where only a few stumps are to be removed. Data are included showing the profit resulting from destructive distillation of pine stumps and waste wood. This amounted to \$37.11 per acre where the combination of pulling and blasting was used for clearing, and \$26.20 per acre where blasting alone was used.

The chemistry of Portland cement and its disintegration by alkaline ground waters, T. THORVALDSON (*Engin. Jour.* [Canada], 5 (1922), No. 9, pp. 457-460).—A summary of studies on the subject by the author and others is presented.

It is stated that at present the only remedy known to prevent the disintegration of concrete by alkaline waters is the manufacture of concrete of low permeability and high strength, together with the exclusion of sulphate waters of high concentration from contact with the concrete. Cheap and efficient methods for the latter practice are said to be not yet available.

Moments and stresses in slabs, H. M. WESTERGAARD and W. A. SLATER (*Amer. Concrete Inst. Proc.*, 17 (1921), pp. 415-538, figs. 68; also *Natl. Research Council, Reprint and Circ. Ser.*, No. 32 [1921], pp. 124, figs. 68).—This is a contribution from the University of Illinois and the U. S. Bureau of Standards. Its purpose is to present information which correlates the results

of tests of a fairly large number of slab structures with the results of analysis, to aid in the formulation of construction regulations for slabs. The report is divided into an analysis of moments and stresses in slabs, a study of the relation between the observed and the computed steel stresses in reinforced-concrete beams, and a study of the test results for flat slabs with a view to comparing the moments of the observed steel stresses with the bending moments indicated by the analysis and of estimating the factor of safety. A bibliography is appended.

Economy of plain and reinforced paving bases compared, J. A. McCABE (*Concrete [Detroit]*, 21 (1922), No. 2, pp. 49, 50).—Comparative laboratory studies of plain and reinforced concrete paving bases are briefly reported which showed that an 8-in. plain concrete pavement may be expected to be about 180 per cent stronger than a 6-in. plain concrete pavement with identical concrete. A 6-in. reinforced concrete pavement will be about 300 per cent stronger than the 6-in. plain concrete, and will cost about the same as 8-in. plain concrete.

Motor transportation in rural Ontario, D. R. COWAN and F. C. HART (*Ontario Dept. Agr. Bul.* 277 (1920), pp. 24, figs. 9).—The results of a survey of the operations of some 400 truck owners operating in rural districts of Ontario are briefly reported, the purpose being to indicate the factors influencing the cost of trucking. It is concluded that the conditions to be inquired into before starting a motor route into any particular locality are the times of shipment of the tonnage available, character of the tonnage, possibility of obtaining return loads, roads, and existing transportation facilities.

Steam power plant auxiliaries and accessories, T. CROFT (*New York and London: McGraw-Hill Book Co., Inc.*, 1922, pp. XV+447, figs. 403).—The purpose of this book is to give such data as will enable the steam power plant operator to select and properly install auxiliary equipment which will insure the generation of power at the least cost. It is further attempted to provide the information whereby this auxiliary equipment can be so operated and maintained that its preventable losses will be at a minimum and its upkeep expense will be as small as is feasible.

The heat value of corn, W. L. DEBAUFRE (*Power*, 56 (1922), No. 6, p. 212).—In a contribution from the University of Nebraska, the results of studies of the heat value of four varieties of corn are reported. Practically no difference was found to exist between the heat values of these varieties, and the heat content of cobs per pound was practically the same as that of the grain. The average higher heat value of dry corn was 8,159 B. t. u. per pound and of dry cobs 8,101 B. t. u. per pound. The average lower heat values were 7,579 and 7,577 B. t. u. per pound, respectively.

There was a variation in the heat value, however, which depended upon the percentage of moisture the corn contained. "For fully cured corn containing, say, 10 per cent of moisture, the effective (lower) heat value is approximately 6,700 B. t. u. per pound. A corresponding value for Pittsburg, Kans., coal is 11,800 B. t. u. per pound. Consequently, the heat value of 50 bu. of corn on the cob or of 63 bu. of shelled corn is about equivalent to that of 1 ton of bituminous coal. With coal at \$10 a ton the price of corn on the cob must be less than 20 cts. a bushel of 70 lbs., and of shelled corn less than 16 cts. a bushel of 56 lbs., to make it more economical to burn than to purchase coal. This comparison does not include any allowance for the cost of handling either fuel."

It is noted that a given amount of corn will produce more useful heat after storage than before, even though less weight of material is present owing to evaporation during storage.

The hot-spot method of heavy fuel preparation, F. C. Mock and M. E. CHANDLER (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 1, pp. 27-32, 48, figs. 9).—On the basis of the belief that the sole requirement of satisfactory internal-combustion engine operation with kerosene and mixtures of the heavier oils with alcohol and benzol is the proper preparation of the fuel in the manifold, the authors studied the various methods of heat application in an endeavor to produce the minimum temperature necessary for a dry mixture.

Finding that this minimum temperature varied with the method of application of the heat, an analysis was made of the available methods on a functional rather than on a structural basis. These included (1) the application of the heat from the walls of the manifold through the medium of the air, (2) application to the fuel alone or partly to the fuel and partly to the air, and (3) directing a spray of atomized fuel and air against a heated surface. A device is described by which the three main variables, the exhaust temperature, exhaust flow, and area of the heating surface, may be regulated, and the three remaining variables, quantity of air, quantity of fuel supplied, and quantity of fuel vaporized, may be controlled.

Taking into account the wide range of temperatures that the air charge and fuel supply undergo before entering the intake-manifold system, a quantitative computation of heat transfer was made. The conclusions were drawn that only by a combination of centrifugal force, surface tension, and the force of gravity can the unvaporized drops be separated from the fuel charge, and that the conditions of combustion are governed by the rate of fuel feed from the manifold to the cylinder and not from the carbureter to the manifold.

The measurement of the property of oiliness, R. E. WILSON and D. P. BARNARD, IV (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 2, pp. 143-156, figs. 17).—Studies conducted at the Massachusetts Institute of Technology are reported, in which a number of possible methods of measuring the property of oiliness and of throwing light on the mechanism of partial lubrication are described. The term oiliness is defined as that property of lubricants by virtue of which one fluid gives lower coefficients of friction, generally at slow speeds or high loads, than another fluid of the same viscosity.

The results of the preliminary studies with the methods described are taken to indicate that the static friction test, with proper refinements, is the best single measure of the properties of oiliness, but that it should be supplemented by measurements of the thickness of the adsorbed films at high pressure in order to throw more light on the mechanism of the action of different constituents in lubricating oils. Animal and vegetable oils were found to be almost invariably superior in oiliness to straight mineral oils. Blending of these in proper proportions is said to greatly improve the oiliness of the latter.

The results are considered to confirm the hypothesis that oiliness is due to selective adsorption of constituents in the oil by the metal surface, but the common conception of a monomolecular adsorbed film that acts merely by masking the attractive forces of the metal surfaces for one another appears to be incorrect. The adsorbed film is shown to be of colloidal rather than molecular dimensions, is a plastic solid rather than a fluid film, and apparently acts by smoothing over surface irregularities, carrying much of the load and minimizing metal-to-metal contact and abrasion. The structure and physical characteristics of this film seem to be more important than its thickness in determining its efficiency in lowering friction.

It was further found that the constituents of lubricants that form these adsorbed layers can be selectively adsorbed and largely removed from the oil by repeated treatments with very finely divided metals.

The mechanism of lubrication, R. E. WILSON and D. P. BARNARD, IV (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 1, pp. 49-60, figs. 11).—In a contribution from the Massachusetts Institute of Technology studies are reported, the primary object of which was to determine the fundamental mechanism of lubrication to serve as a basis for predicting the precise effect of the different variables under any specified conditions.

The conclusion is drawn that for any normal journal bearing operating in the region of fluid film lubrication, the coefficient of friction is not an independent function of the speed, the load, and the operating viscosity of the fluid at the operating temperature, but is rather a function of their combination in the form $z N/p$, in which z is the viscosity, N the speed in revolutions per minute, and p the load on the bearing.

If the bearing and lubricant are both kept constant, all of the observed values of the coefficient of friction were found to approximate a smooth curve when plotted against $z N/p$. "Starting at very high values of $z N/p$ and decreasing them, all the curves gradually approach a small value of f , generally in the neighborhood of 0.002. Before the ordinate axis is reached, however, the fluid film is ruptured, the coefficients rise very sharply with a further decrease in the $z N/p$ value, and metal-to-metal contact and abrasion take place. The first region is termed the region of fluid film or perfect lubrication; the second, the region of partial lubrication. The intermediate point at which the coefficient is a minimum is the critical point of fluid film rupture."

In the region of perfect lubrication the relation of coefficient of friction to speed, load, and operating viscosity is not affected by the method of oiling or any variation in the oiliness of the lubricant. End leakage tends to give abnormally high friction for short bearings or those having very large clearances. Within the limits of good practice, the character of the bearing metal has no effect.

The use of smaller clearances tends to lower the critical value more than enough to counterbalance the increase in the coefficient of friction in the fluid film region. The use of lubricants of high oiliness tends to lower the critical point. Various bearing metals differ appreciably in their ability to maintain the fluid film at extremely low values of $z N/p$.

In the region of partial lubrication viscosity is by no means the most important property of the lubricant, and the oiliness factor and character of the bearing metals come largely into play, the latter factor having an important effect on the friction. The coefficient of friction is no longer necessarily a function of $z N/p$. The critical value of $z N/p$ may be somewhat different for different combinations of the load and the speed and may change with the temperature.

It is concluded that the only absolute limit to the carrying power of a given bearing is the pressure that will deform the bearing or seriously deflect the shaft. "The efficiency of a bearing should not, however, be judged on the basis of its carrying power nor by the minimum coefficient of friction at the critical point, but rather by the coefficient of friction obtained when it is operating with a reasonable factor of safety. The proper factor of safety will vary with conditions, but as a general proposition the efficiency of a bearing can be measured in terms of the value of f obtained when operating at the value of $z N/p$, which is five times that at the critical point."

Crankcase oil dilution problem and its solution, W. F. PARISH (*Jour. Soc. Automotive Engin.*, 11 (1922), No. 1, pp. 35-47, figs. 14; also in *Engin. World*, 20 (1922), No. 5, pp. 307-314, figs. 11).—This is an extended study of the effect of fuel dilution on the viscosity and consequently the efficiency of the lubri-

ating oils in internal-combustion engines. The carbon-forming properties of oils and the effect of heavy oil upon engine efficiency are discussed. Although the dilution of the lubricant should be at a minimum with one engine operating at full load on the dynamometer stand, results of engine tests extending over the last 10 years show an increase in such dilution of from 2 to 12 per cent.

As a solution of the problem of crankcase dilution, the author offers a system for crankcase oil regeneration consisting of four main elements by which the fuel and water dilution are automatically removed and the sediment composed of carbon particles, sand, and minute pieces of metal filtered out. The operation of this system, which it is claimed will not interfere with the present lubricating system of the engine and functions equally well with the splash and forced-feed systems, is described and illustrated. Charts showing the results obtained from comparative test runs with and without the system are also presented, indicating that its use practically eliminates crankcase dilution.

Mechanics of tillage implements, T. A. MILLER-BROWNLIE (*Agr. Jour. India*, 17 (1922), No. 2, pp. 119-126, figs. 5).—A brief analysis of the mechanics of tillage implements, based on the requirements of Indian soils, is presented.

A new lime spreader, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 26-30, figs. 4).—A simple wagon attachment for lime spreading is described and diagrammatically illustrated, which it is stated can be easily made on any farm. A bill of materials is included. The spreader is designed to be attached to the rear end of the wagon box and operated by a rocker arm dropping from peg to peg on a disk attached to and turning with the rear wheels of the wagon. The rocker arm moves a board under the hopper which serves as an agitator. The jarring action of the rocker arm upon the agitator and box serves to feed down the lime. The machine was successfully tested with pulverized limestone both dry and damp.

Braced rafter barn framing, H. P. TWITCHELL (*Ohio Agr. Col. Ext. Bul.*, 17 (1921-22), No. 8, pp. 20, figs. 22).—This bulletin discusses the braced rafter method of barn framing and includes numerous diagrammatic illustrations and detailed drawings. The braced rafter type of barn construction is recommended for barns not exceeding 36 ft. in width, 18 ft. in height from grade line to plate, and not having thrashing floors. The 34-ft. width is considered to be particularly suitable for dairy barns. This type of barn framing is said to require less lumber and is stronger and more rigid than the timber frame construction. It uses only stock sizes and lengths of lumber, requires only a few men to construct and erect the frame, and has a large unobstructed mow.

Cattle feeding barns and shelters, W. A. FOSTER and R. S. STEPHENSON (*Iowa Sta. Circ.* 74 (1922), pp. 3-23, pls. 3, figs. 25).—This circular describes cattle feeding barns and shelters which have been used by successful breeders and feeders in the State of Iowa for some time. Diagrammatic illustrations and detailed drawings are included.

Feeding equipment for cattle, W. A. FOSTER and R. S. STEPHENSON (*Iowa Sta. Circ.* 75 (1922), pp. 31, figs. 28).—This circular describes, illustrates, and gives bills of material for equipment used in the feeding of beef cattle, with particular reference to conditions in Iowa. The equipment described includes bunks, mangers, self-feeders, watering tanks, water storage tanks, cattle stocks, shipping crates, scale pens, manure pits, dipping vats, silage carriers and carts, and feed lots.

The pit silo, S. P. CLARK (*Arizona Sta. Timely Hints for Farmers*, No. 140 (1922), pp. 12, figs. 6).—Practical information on the design and construction of pit silos, with particular reference to conditions in Arizona, is presented in this publication, which supersedes a previous publication on the same subject (*E. S. R.*, 36, p. 91).

The ventilation of potato warehouses, F. E. FOGLE (*Michigan Sta. Quart. Bul.* 5 (1922), No. 1, pp. 20-25, figs. 6).—Practical information on the ventilation of potato warehouses, with particular reference to conditions in Michigan, is presented. Successful storage is said to depend on the maintenance of a dry atmosphere and a low temperature in the storage house. A temperature of from 33 to 38° F. is considered to be desirable. There should be a movement of air through as well as around the potato piles. To accomplish this it is recommended that the potato bins be not wider than 8 ft. nor deeper than 10 ft. The bins should be kept some distance from the outside walls. It is stated that both the King and Rutherford ventilating systems have been successfully adapted to potato storage houses in Michigan.

Power's practical refrigeration (New York: McGraw-Hill Book Co., Inc., 1921, pp. VIII+283, figs. 103).—This book consists mainly of the contents of articles on refrigeration which have appeared in the *Power* magazine. It deals with the practical side of refrigeration but includes the essential laws covering the production of refrigeration. It contains chapters on the refrigerating and steam plant, the ammonia compressor, use and care of the compressor, the ammonia condenser, the evaporating system, insulation, operation of the compression system, the absorption system, the carbon dioxide machine, and tests.

A simple septic tank for the farm, V. OVERHOLT (*Ohio Agr. Col. Ext. Bul.*, 17 (1921-22), No. 11, pp. 8, figs. 7).—Practical information on the construction of a single chamber so-called septic tank is given together with detail drawings.

RURAL ECONOMICS AND SOCIOLOGY.

Farm management in Catawba County, N. C., J. M. JOHNSON and E. D. STRAIT (*U. S. Dept. Agr. Bul.* 1070 (1922), pp. 23, figs. 6).—This study is based on a farm business analysis survey of 297 farms for the year 1912 and of 304 farms for the year 1918 in Catawba County, N. C., near the center of the western or more elevated part of the Piedmont region of the State. Census reports for that county from 1850 to 1920, inclusive, are also used.

General crop farming with live stock is the type followed. In 1912 the 297 farms studied averaged 121 acres in size, 57 per cent of the land being tillable. In 1918 the 304 farms studied averaged 111.5 acres in size, 58 per cent of the land being tillable. Most of the untillable land was in woods or in pasture. In 1912 the average value of real estate was \$45 per acre and in 1918, \$66. The average capital invested in the farms in 1912 was \$6,530, and in 1918 it was \$8,858. About 83 per cent of this represented real estate. In 1912 a working capital of \$1,070 and in 1918 of \$1,461 was required to operate the average farm.

For 1912 the average labor income was \$86 and for 1918 it was \$542, while the corresponding average family incomes were \$546 and \$1,166, respectively. The value of food products, fuel, and use of house furnished by the farm in 1912 averaged \$328 per farm and in 1918 \$573. In 1912 for all farms of 30 crop acres or under the average amount of the family income was \$260, and in 1918, \$611; for the farms of over 70 crop acres the family income in 1912 averaged \$1,144 and in 1918 \$2,225.

In 1912 64 per cent of all the receipts were from crops, 24 per cent from stock, 3 per cent from woodland products, 3 per cent from increase in inventory of feed, and 6 per cent from miscellaneous sources, consisting principally of labor. In 1918 69 per cent of the receipts were from crops, 22 per cent from stock, 1 per cent from woodland products, 3 per cent from increase in inventory of feed, and 5 per cent from miscellaneous sources. In 1912 37 per cent of the farm receipts were from cotton and cotton seed, while in 1918 39 per cent of the re-

ceipts were from this crop. In 1912 7 per cent and in 1918 10 per cent of the receipts were from sweet potatoes.

In 1912 24 per cent of the crop area was in wheat, and in 1918 28 per cent. The corn crop occupied 28 per cent of the crop area in 1912 and 26 per cent in 1918. It is found that for both years the farmers making the highest farm incomes were those growing the smallest acreage of corn. The cotton crop occupied 19 per cent of the crop area in 1912 and 15 per cent in 1918. With the exception of sweet potatoes, cotton returned higher receipts per acre than any other crop that is extensively grown in this area.

In 1912 and in 1918 about 9 per cent of all the farm receipts were derived from the sale of dairy products. In 1912 88 per cent and in 1918 83 per cent of the farmers sold some dairy products.

Suggested crop rotations are included covering from 2 to 5 years.

A successful two-man farm, H. C. WOODWORTH (*N. H. Agr. Col. Ext. Circ. 50* (1922), pp. 12, figs. 4).—The management of a farm of 300 acres near Lebanon, N. H., which is operated as a two-man farm and which maintains a Jersey herd of 26 cows and 20 head of young stock, is described in detail. Records show that each man accomplishes over 280 days of productive work in the year. A rotation of corn, oats, clover, and hay is followed. The land that is easily worked is in cultivation, and stony and rough land is used for meadow, pasture, or timber lot. The cash crops are oats, hay, and timber.

Valuation of rural property, F. CONVERT (*Vie Agr. et Rurale*, 18 (1921), Nos. 16, pp. 245-247; 17, pp. 261-263; 18, pp. 277-279; 20, pp. 309-311).—This paper points out the difficulties of determining land prices and defines theoretical and practical concepts of rural land values in France.

The current selling price is held to be the single true measure of its value, but since there is no established market and because of the fact that many personal and special factors enter into land prices, it is necessary to interpret them for the purpose of land valuation. It is necessary to distinguish between the value of the bare land and that of the corresponding usufruct, also between the value of separate parcels and that of the entire domain, and to know such items as its credit value; value in case of damages, such as modifications in the water supply, the effects of industries on adjoining property, the extraction of resources with temporary occupation, the results of military maneuvers or the ravages of war, etc., also its insurance value; value from the point of view of assessments for collective drainage and other projects, and most particularly that of territorial reorganization; and finally the fiscal value upon which taxes are imposed. Discussing this last factor, the author goes into recent legislation governing the cadastre and land tax. Reforms are held to be very necessary in this connection but very difficult.

Revision of legislation relating to farm leases, E. LEPLAE (*Rev. Gén. Agron.*, n. ser., 12 (1922), No. 3, pp. 85-128).—Debates of a special higher council investigating the advisability of the revision of legislation relating to farm leases in Belgium are given here from the secretary's minutes. Such topics are discussed as the length of a lease contract not in writing, the necessity of a written lease, the notification necessary before terminating a lease, the amount of liberty to be granted in the choice and sale of crops, the legal nature of tacit renewals of lease, conditions under which a lease may be canceled, conditions of subleasing, privileges of the lessor, the situation with regard to rural property under public administration, indemnity payable to outgoing tenants, and the destruction of rabbits. The opinion of the majority of the members with regard to debated questions was ascertained by vote.

Report of the land and agricultural bank of South Africa for the year ended December 31, 1921, T. B. HEROLD ET AL. (*Union So. Africa, Land and Agr. Bank So. Africa, Rpt. 1921, pp. 35*).—Inspectors' reports on agricultural conditions in various local areas of the Union of South Africa are given. The number of applications for fencing advances is shown to have varied from year to year between 1912 and 1921. More of such advances were received in 1921 than in any year since 1914. A recent outbreak of East Coast fever increased a number of applications for dipping tank advances. Other loans made were for drought and flood distress relief.

The remainder of this report is given to information relative to cooperative agricultural societies borrowing funds from the bank, schedules of applications received, and advances authorized or given, together with the financial statements.

Agricultural wages and wage earners in Norway and Sweden, V. B. TURNER (*U. S. Dept. Labor, Bur. Labor Statist., Mo. Labor Rev., 15 (1922), No. 3, pp. 116-130*).—This is a compilation from Swedish official and other sources of the number of agricultural laborers, their hours of working, and wages in recent years.

Economics for executives.—VI, Marketing, edited by G. E. ROBERTS (*New York: Amer. Chamber Econ., Inc., 1922, pp. 76*).—This is one of a series of study units designed as a practical interpretation of the underlying principles of economics and business. Marketing is analyzed here as a system functioning to make adjustments according to consumers' demands in the place, time, quality, and quantity of goods offered for sale. Two tendencies toward the elimination of the middleman through integration and cooperation are pointed out. Two central trading functions of the marketing system are said to have to do with price making and the assumption of risks, both involved with exchanges, speculation, future trading, hedging, warehousing, and cold storage. Advertising is discussed from the social point of view as the means of making contacts between producers, middlemen, and consumers. Freedom of enterprise and competition are essential for the rendering of this service, and its benefits are most pronounced in those industries subject to the law of diminishing unit costs.

The important factors in determining standard grades for fruits and vegetables, H. W. SAMSON (*Natl. Assoc. State Marketing Off. Proc., 3 (1921), pp. 3-10*).—The conclusion is said to have been reached that in States where the majority of the growers are unwilling to submit to grading regulations the wisest policy is to make the States' standards permissive, as official marketing agencies may then use them as a basis for an educational program. It is shown how investigation and experience have taught the best local designation of grades for fruits and vegetables according to variety and the locality where grown.

Standardization and inspection service as it has developed in California, F. W. READ (*Natl. Assoc. State Marketing Off. Proc., 3 (1921), pp. 10-18*).—The legislative history of standardization in California and the development of methods for the work in the State are set forth in detail.

Friesian farming products (*Leeuwarden: Friesian Agr. Soc., 1921, pp. 28, figs. 41*).—This gives a brief description of products of Friesian farms, the characteristics to which special attention should be paid when buying them, and a directory of sellers.

Cotton marketing, T. G. HESSE (*Union So. Africa Dept. Agr. Jour., 4 (1922), No. 6, pp. 521-533*).—The subject is presented under the heads of requirements of the spinner, how to meet these requirements, ginning of cotton, the necessity of uniform baling, grading of cotton, central ginneries v. farm

ginneries, and the selling of cotton. It is deemed desirable to model the procedure for the marketing of cotton from the Union of South Africa on the rules and customs governing the American cotton trade, and the discussion is based on that system.

Marketing the fruit crop (*Australasian Fruitgrowers' Ann. and Trade Rec. 1922, pp. 67, 69, 71*).—The ranking importance of several cities in Australia as possible markets for the increasing fruit production of Australia and New Zealand is set forth. The foreign demand is briefly discussed.

The cooperative elevator movement: A study in grain marketing at country points in the North Central States, J. B. KENKEL (*Diss., Catholic Univ. Amer., Washington, D. C., 1922, pp. VI+155*).—This dissertation is a compilation giving a historical survey of the farmers' organizations interested in grain marketing, of which the Grange was one of the earliest and the Nonpartisan League and the American Farm Bureau Federation are the latest. It is intended to show in what way they have promoted the cooperative elevator movement. The plan of organization of local associations and the scope of their activities, also questions dealing with their internal management, incorporation, provisions of by-laws, volume of business carried on, and distribution of profits, are discussed in detail. It is pointed out that certain definite economic results have been achieved in the way of raising prices of grain, maintaining competitive conditions, and effecting savings in the cost of handling grain. These cooperative organizations are held to have been rural socializing agencies as well. Factors of success are loyal membership, efficient management, and organized, centralized effort.

The present is looked upon as a "critical period in the history of the cooperative elevator movement—in the sense that its future growth or retardation is closely bound up with the success or failure of the plan devised by the 'Committee of Seventeen' and finding application in the U. S. Grain Growers, Inc."

Addresses on cooperative marketing, A. SAPIRO (*Toronto: Ontario Dept. Agr., 1922, pp. 3-16, 26-39*).—Two papers are here noted.

Benefits of cooperation defined.—It is held a fundamental condition of success in cooperative marketing that organization be on the commodity basis. Orderly marketing of merchandising as opposed to dumping is said to depend upon inspection and grading to improve quality, getting the proper type of package, and extending the marketing period, first as to time, next by extending the marketing as to place and location, and then by controlling the movement of the crop by considering the supply at the point of consumption instead of at the point of production.

Points in the California plan.—The principles set forth above are restated, and it is held that they will cause the price to be fixed on the basis of the supply at the point of consumption. The organization of Burley tobacco growers on the long-term contract, internal-pooling plan is described.

The relation of the Government crop reports to marketing, L. M. ESTABROOK (*Natl. Assoc. State Marketing Off. Proc., 3 (1921), pp. 18-24*).—This outlines briefly some of the contemplated improvements in the Government crop-reporting service.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 2 (1922), Nos. 10, pp. 193-208, figs. 4; 11, pp. 209-224, figs. 5; 12, pp. 225-256, figs. 4; 13, pp. 257-280, figs. 3; 14, pp. 281-296, figs. 2*).—Temperature and precipitation charts for the weeks ended August 29 and September 5, 12, 19, and 26, respectively, with weekly summaries of weather conditions, are presented here, as well as the usual tabulated weekly reports of receipts and prices of important products, the position in the markets of particular com-

modities, foreign market prospects, and reports on crop condition. The September crop report contained in No. 12 includes the usual tabulated summaries of crop conditions and the estimated farm value of important farm crops, live stock, and other products, and averages of prices received by producers. A summary of foreign crop prospects prepared as of September 13, 1922, is given in the same number.

Introduction to rural sociology, P. L. VOGR (*New York and London: D. Appleton & Co., 1922*, [2. ed.], pp. XVI+457, figs. 24).—This is a second edition, slightly revised and enlarged, of the work previously noted (E. S. R., 38, p. 89).

The rural mind and social welfare, E. R. GROVES (*Chicago: Univ. Press, 1922*, pp. XIV+205).—An analysis is made of the social experiences and the social psychology of country people. Chapters are devoted to discussion of the rôle of the instincts in rural social life. The author deplores the lack of adequately trained and paid leadership, cultural opportunity, and professional standing for its ministers and the insufficient equipment so characteristic of rural churches. It is urged that the country church and any other agency working toward rural social organization must give due regard to the characteristic psychology of the rural population.

[Suggested activities for county and city interracial committees, with reference to rural problems] (In *Cooperation in Southern Communities.—Suggested Activities for County and City Interracial Committees*, edited by T. J. WOOFER, JR., and I. FISHER. *Atlanta, Ga.: Comm. on Interracial Coop., 1921*, pp. 21-23, 50-54).—Two papers are here noted.

Improving rural schools, J. H. DILLARD.—It is urged that local committees of the interracial commission may bring about better accommodations, better terms, and better teachers for rural colored schools.

Rural recreation, L. T. LARSEN.—Certain community activities are suggested to which the school building may be adapted. Possible difficulties that may be met with in the introduction of organized play in rural districts are outlined, with suggestions as to how to meet them.

Uses of rural community buildings, W. C. NASON (*U. S. Dept. Agr., Farmers' Bul. 1274 (1922)*, pp. 32, figs. 15).—Certain community buildings included in a study previously noted (E. S. R., 42, p. 489) are cited in groups according to the activities for which they were most often used, as economic, political, religious, social, hygienic, athletic, and special. Brief descriptions are given of community buildings constructed or acquired under a variety of conditions and serving different types of communities. Those chosen as examples are buildings serving a farming community emphasizing the county agent feature, another the farmers' clubs, others the stock show, the fire department, war memorial, motion picture, commercial club, and church control features.

AGRICULTURAL EDUCATION.

Report on the work of the Intelligence Department of the Ministry for the two years 1919-1921, A. D. HALL (*Min. Agr. and Fisheries [London], Intel. Dept. Rpt., 1919-1921*, pp. 198).—This is the first report of this department of the British Ministry of Agriculture and Fisheries to be published since 1914. The report embraces not only the dealings of the Ministry with education and research but also all of those which attempt to influence the development of agriculture by supplying the farmer with stimulus and control. It covers the activities with relation to agricultural education and research, agricultural training of ex-officers and men, horticultural extension, improvement of live stock, destruction of rats, and control of diseases of animals. New

developments at certain university departments of agriculture in Great Britain are noted. Short descriptions are given of new farm institutes, residential instruction and demonstration farms, day courses, and other means of promoting agricultural education. Advisory work at institutions having an agricultural department is outlined, and schemes for the training of ex-service officers and men are described in detail. The remainder of the report consists of details of demonstrations carried out in horticulture and live-stock improvement.

A course to train specialists in agronomy, D. W. ROBERTSON (*Sci. Agr.*, 2 (1922), No. 10, pp. 328-331).—Agronomy is divided into three main groups of crops, soils, and plant breeding, and several courses are listed under each. The number of credit hours required for degree work is held to be from 130 to 150, and the distribution of these among the several courses is outlined. Prerequisites of each of the courses and the distribution of studies through a four-year course is similarly presented. The points are made that any one of the three groups would fit a student as a teacher of agronomy, and that a specialist in any one of the groups has sufficient foundation for advance work in that direction. Certain sciences are held to be fundamental to each of the groups. The student specializing in crops should take more botany than is required and in soils more chemistry. Those intending to pursue graduate study should take more mathematics.

The function of the college marketing course in relation to marketing problems, T. MACKLIN (*Natl. Assoc. State Marketing Off. Proc.*, 3 (1921), pp. 37-42).—This function is held to be to provide personnel acquainted with facts and policies and equipped to carry on marketing work.

A village history exhibition as an educational factor: An example from the Weald of Kent, G. EWING (*Jour. Min. Agr. [London]*, 29 (1922), No. 7, pp. 617-622).—This is an account of a successful local history exhibit held by a village club in Kent, England. It accomplished the purpose of raising funds for the club, but more than that served to turn the attention of the community to its own history and to draw the people together in a common interest.

Debates, plays, and community music for rural social organizations, O. J. STEVENSON (*Ontario Agr. Col. Spec. Bul.*, May, 1922, pp. [20], fig. 1).—Suggestions are offered for debates, arranging and rehearsing plays, and encouraging community singing. Lists of debatable subjects and of suitable plays are given.

Arbor Days and Bird Days, T. E. FINEGAN (*Harrisburg: Penn. Dept. Pub. Instr.*, 1922, pp. 60, figs. 42).—Information on birds, trees, and shrubs of Pennsylvania is assembled here for use in promoting the observance of Arbor Day and Bird Day among the children of the public schools.

Home economics in the elementary and secondary schools, A. K. HANNA (*Boston: Whitcomb & Barrows*, 1922, pp. V+327).—This textbook is planned primarily for students in special methods courses in home economics in colleges and normal schools. It is expected that students who use this book will have completed the prerequisite courses in foods, clothing, shelter, household management, etc., as well as courses in education which have given them the elements of educational methods, principles, and administration.

Part 1 is devoted to the subject matter and methods of home economics. Methods of using the home project in teaching home economics are discussed, as well as laboratory methods, motor training, and the use of textbooks and laboratory manuals. Other chapters in this section are devoted to practical teaching problems in connection with food and its preparation, food selection, sewing, the selection of clothing, the house and its selection, and household

management. Part 2 deals with the status of home economics in the schools, aims of teaching, home economics in vocational and liberal education, and the natural and social sciences and art, coordinated with home economics. A chapter is devoted to the content of courses in elementary schools and secondary courses, and the appendix contains an outline of a course suggested as a required unit to be offered in the ninth or tenth grade.

The evolution of a nutrition class program, G. G. MUDGE (*Jour. Home Econ.*, 14 (1922), No. 9, pp. 421-424).—This article describes briefly a method of procedure in nutrition class work, outlining the subjects of a series of special class lessons for undernourished children in the first three grades of the public school, conducted by the American Red Cross in two neighborhoods in New York City, and noting also the procedure with an entire third-grade class.

MISCELLANEOUS.

Thirty-fourth Annual Report of Illinois Station, 1921, E. DAVENPORT (*Illinois Sta. Rpt. 1921*, pp. 20).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, brief notes as to the principal lines of work, and a list of publications of the year. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Thirtieth Annual Report of Oklahoma Station, 1921, C. T. DOWELL (*Oklahoma Sta. Rpt. 1921*, pp. 32, figs. 3).—This contains a report of the director on the work, publications, and needs of the station and a financial statement for the fiscal year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Porto Rico Insular Station, 1921, F. D. COLÓN ET AL. (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt.*, 1921, pp. 68).—This contains the organization list, a report by the director for the fiscal year ended June 30, 1921, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul.*, 5 (1922), No. 1, pp. 46, figs. 18).—In addition to articles abstracted elsewhere in this issue, this number contains the following: The Future of Pork, and Wool and Mutton Production, both by G. A. Brown; Great Increase in Alfalfa Acreage, Michigan-grown Alfalfa Seed, and Cleaning up Clover-seed Fields, all by J. F. Cox; and Avian Tuberculosis, by H. J. Stafseth.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul.*, 7 (1922), No. 7-8, pp. 105-136, figs. 13).—This number contains, in addition to several articles abstracted elsewhere in this issue and miscellaneous notes, an article entitled The Fall Webworm, by J. S. Houser.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul.*, 10 (1922), No. 3, pp. 49-64, figs. 18).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Fall Berry Field Practices, by J. L. Stahl; Home-grown Kale and Mangel Seed, by M. E. McCollam; and Mosaic, a Serious Disease of Potatoes, by A. Frank.

NOTES.

Kansas College and Station.—During the biennium ended June 30, 21 agricultural organizations held one or more meetings at the station. Each of 17 of these organizations held two such meetings. It is estimated that individual visitors, plus the attendance at these meetings and at the two "round ups" and one Sorghum Day held at the Hays Branch Station, and two Feeders' Days held at Manhattan, numbered more than 20,000. On October 25 a party of 350 members of the Kansas Bankers' Association visited the college and station.

Experiments with Sudan grass as a pasture crop for dairy cows, which have been conducted at Manhattan and at the four branch stations at altitudes of 1,000, 2,000, 2,500, 3,000, and 3,600 feet, have shown that this grass is a highly reliable and valuable one for pasture purposes in practically every section of the State. Under reasonably favorable conditions of care and management its carrying capacity seldom is less than one cow per acre for 90 days. One of the chief values of Sudan grass as a pasture crop in Kansas is that it supplies abundant pasturage at a time of year when most other plants supply little or none, viz, during late summer and early autumn.

A steer feeding experiment covering a five-months period has been completed during which some interesting observations were obtained on the use of salt. During the experiment the salt consumption of steers receiving corn silage without hay averaged 46.63 lbs. per head, or three times that of steers in a comparable lot which were fed alfalfa hay alone and which consumed an average of 15.59 lbs. of salt per head.

Massachusetts College.—Charles W. Kenup has been appointed field professor in teacher training.

Nebraska University and Station.—A beef cattle barn for the department of animal husbandry has just been completed. This barn is 38 by 128 ft. with an annex 24 by 100 ft., is built of hollow tile and stucco, with yards attached, and has provision for hay and grain storage. The cost of the barn was approximately \$30,000.

Ohio Station.—W. F. Rofkar, a 1922 graduate of the Ohio State University, has been appointed assistant in horticulture vice Paul Thayer.

Oklahoma College and Station.—Dr. Lowery Laymon Lewis, associated with the veterinary work of the institution since 1896, died September 26 at the age of 52 years.

Dr. Lewis was a graduate of the Texas College, also receiving the M. S. degree from the same institution in 1893 and that of D. V. M. from the Iowa College in 1896. His initial appointment in Oklahoma was as professor of veterinary medicine and State veterinarian, but in 1899 he also became professor of zoology and station bacteriologist, and in 1900, dean of the school of veterinary medicine. In 1913 he was also appointed dean of the school of science and literature, and in 1921 dean of the faculty. He served as acting president of the college and acting director of the station in 1915. Among the subjects of research studied by him were those of parasiticides, anthelmintics, and disinfectants, the prevention and control of hog cholera and tuberculosis, and more recently sterility in live stock.

Association of Feed Control Officials of the United States.—The fourteenth annual meeting of the association, held at Washington, D. C., on November 13 and 14, 1922, was attended by officials from 19 different States, as well as representatives from Canada, the U. S. Department of Agriculture, and commercial interests. A short address of welcome was given by the Secretary of Agriculture, extending the services of the Department to the association.

The address of President W. F. Hand of Mississippi was centered about better uniformity in feed legislation, labeling, and registration of feeds in the different States, and the main discussions of the association seemed to indicate that all were in favor of cooperation to increase uniformity. Types of labels and registration blanks were presented which it was thought would be accepted by nearly all the States represented. Papers were also presented as follows: The Development of Modern Organization for Regulatory Work, by W. G. Campbell; The Importance of Hay in the Rations of Dairy Cows, by E. B. Meigs; The Milling of Wheat Flour with Special Reference to Feed Production, by H. Snyder; and The Feed Manufacturer's View of Some Pressing Problems in Feed Control Work and Administration, by F. L. Brown.

For the coming year the following officers were elected: President, H. H. Hanson of Delaware; vice-president, H. A. Halverson of Minnesota; and secretary-treasurer, A. W. Clark of New York. J. K. Haywood of the Bureau of Chemistry, U. S. Department of Agriculture, and J. W. Sample of Tennessee were elected as the remaining members of the executive committee.

Farm Institutes in Great Britain.—The number of these institutions in England and Wales has now been increased to twelve. Two of them, the Chadacre Agricultural Institute, Suffolk, and Monmouthshire Agricultural Institution at Usk have been established through funds supplied by private individuals, but the remainder are maintained by the county councils with financial assistance from the Ministry of Agriculture and Fisheries.

Instruction at the institutes is mainly of secondary grade, usually covering the six winter months but in one or two cases extending over an entire year. In most cases, the summer is devoted to instruction in dairying and related lines for women. The institute is also the headquarters of the county staff of agricultural lecturers and serves as a center for demonstrations.

Proposed National Poultry Institute in Great Britain.—Announcement is made that the Development Commissioners of Great Britain have approved the expenditure of £19,500 for the establishment of a National Poultry Institute. This grant is conditioned on the raising of £6,500 from the poultry industry itself. About £6,000 per annum is also expected to be granted from the Development Fund for maintenance.

Miscellaneous.—A recent issue of *Science* notes that in the will of Prince Albert of Monaco, who died June 26, his farm at Sainte Suzanne has been left to the French Academy of Agriculture. The wish is expressed that the farm should be maintained as a place for agricultural experiments to demonstrate what science can obtain from sterile lands.

The French Ministry of Agriculture is requesting an annual grant of 500,000 francs for the purpose of instituting, in agricultural colleges and schools and in rural communes, moving picture apparatus to be used for the popularization of scientific agriculture.

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